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JOURNAL

OF THE

FRANKLIN INSTITUTE

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OF THE

State of Pennsylvania;

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED

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JANUARY, 1829.

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*An account of Mr. James Brindley, the late celebrated Civil Engineer.**

JAMES BRINDLEY was born at Tunsted, in the parish of Wormhill, Derbyshire, in 1716. His father was a small freeholder, who dissipated his property in company and field amusements, and neglected his family. In consequence, young Brindley was destitute of even the common rudiments of education, and till the age of seventeen, was casually employed in rustic labours. At that period, he bound himself to one Bennet, a mill-wright, at Macclesfield, in Cheshire, where his mechanical genius presently developed itself. The master being frequently absent, the apprentice was often left for weeks together, to finish pieces of work, concerning which he had received no instruction; and Bennet, on his return, was often greatly astonished to see improvements in various pieces of mechanism, of which he had no previous conception. It was not long before the millers discovered Brindley's merits, and preferred him, in the execution of their orders, to the master or any other workman. At the expiration of his servitude, Bennet being grown into years, he took the management of the business upon himself; and by his skill and industry, contributed to support his old master and his family in a comfortable manner.

In process of time, Brindley set up as a mill-wright, on his own account, and by a number of new and ingenious contrivances, greatly improved that branch of mechanics, and acquired a high reputation in the neighbourhood. His fame extending to a wider circle, he was

* From the late Dr. John Aikin's "Description of the country round Manchester."

employed, in 1752, to erect a water-engine, at Clifton, in Lancashire, for the purpose of draining some coal-mines. Here he gave an essay of his abilities, in a kind of work for which he was, afterwards, so much distinguished, driving a tunnel under ground, through a rock nearly six hundred yards in length, by which water was brought out of the Irwell, for the purpose of turning a wheel fixed thirty feet below the surface of the earth. In 1755, he was employed to execute the larger wheels for a silk-mill, at Congleton; and another person who was engaged to make other parts of the machinery, and to superintend the whole, proving incapable of completing the work, the business was entirely committed to Brindley; who not only executed the original plan in a masterly manner, but made the addition of many curious and valuable improvements, as well in the construction of the engine itself, as in the method of making the wheels and pinions belonging to it. About this time, too, the mills for grinding flints in the Staffordshire potteries, received various improvements from his ingenuity.

In the year 1756, he undertook to erect a steam engine, on a new plan, at Newcastle-under-line; and he was, for a time, very intent upon a variety of contrivances for improving this useful piece of mechanism. But from these designs he was, happily for the public, called away to take the lead in what the event has proved to be a national concern of capital importance—the projecting the system of canal navigation. The duke of Bridgewater, who had formed his design of carrying a canal from his coal works, at Worsley, to Manchester, was induced, by the reputation of Mr. Brindley, to consult him on the execution of it; and having the sagacity to perceive, and strength of mind to confide in, the original and commanding abilities of this self-taught genius, he committed to him the management of the arduous undertaking. Mr. Brindley, from the very first, adopting those leading principles in the projecting of these works, which he ever afterwards adhered to, and in which he has been imitated by all succeeding engineers. To preserve as much as possible the level of his canals, and to avoid the mixture and interference of all natural streams, were objects at which he constantly aimed. To accomplish these, no labours and expense were spared; and his genius seemed to delight in overcoming all obstacles to them, by the discovery of new and extraordinary contrivances.

The most experienced engineers upon former systems, were amazed and confounded at his projects of aqueduct bridges over navigable rivers, mounds across deep vallies, and subterraneous tunnels; nor could they believe in the practicability of some of these schemes, till they saw them effected. In the execution, the ideas he followed were all his own; and the minutest, as well as the greatest, of the expedients he employed, bore the stamp of originality. Every man of genius is an enthusiast. Mr. Brindley was an enthusiast in favour of the superiority of canal navigation, above those of rivers; and this triumph of art over nature, led him to view, with a sort of contempt, the winding stream in which the lover of rural beauty so much delights. This sentiment he is said to have expressed in a

striking manner, at an examination before a committee of the house of commons, when, on being asked, after he had made some contemptuous remarks relative to rivers, what he conceived they were created for:—he answered, "to feed navigable canals." A direct rivalry with the navigation of the Irwell and the Mersey, was the bold enterprise of his first great canal; and since the success of that design, it has become common all over the kingdom, to see canals accompanying, with insulting parallel, the course of navigable rivers.

After the successful execution of the duke of Bridgewater's canal to the Mersey, Mr. Brindley was employed in the revived design of carrying a canal through the counties of Chester and Stafford. This undertaking commenced in the year 1766; and from the great ideas it opened to the mind of its conductor, of a scheme of inland navigation, which should connect all the internal parts of England with each other, and with the principal sea-ports, by means of branches from this main stem, he gave it the emphatical name of the *Grand Trunk.* In executing this, he was called upon to employ all the resources of his invention, on account of the inequality and various nature of the ground to be cut through; in particular, the hill of Harecastle, which was only to be passed by a tunnel of great length, bored through strata of different consistency, and some of them mere quicksand, proved to be a most difficult, as well as expensive obstacle, which, however, he completely surmounted. While this was carrying on, a branch from the Grand Trunk, to join the Severn near Bewdley, was committed to his management, and was finished in 1772. He also executed a canal from Droitwich to the Severn; and he planned the Coventry canal, and for some time superintended its execution, but on account of some difference in opinion, he resigned that office. The Chesterfield canal, was the last undertaking of the kind which he conducted, but he only lived to finish some miles of it. There was, however, scarcely any design of canal navigation set on foot in the kingdom, during the latter years of his life, in which he was not consulted, and the plan of which he did not either entirely form, or revise and improve. All these it is needless to enumerate; but as an instance of the vastness of his ideas, it may be mentioned, that on planning a canal from Liverpool, to join that of the duke of Bridgewater's, at Runcorn, it was part of his intention to carry it by an aqueduct bridge across the Mersey, at Runcorn-gap, a place where a tide sometimes rising fourteen feet, rushes with great rapidity through a sudden contraction of the channel. As a mechanic and engineer, he was likewise consulted on other occasions; as with respect to draining of the low lands in different parts of Lincolnshire, and the isle of Ely, and to the cleansing of the docks of Liverpool, from mud. He pointed out a method, which has been successfully practised, of building sea-walls without mortar; and he was the author of a very ingenious improvement of the machine for drawing water out of mines, by the contrivance of a gaining and losing bucket.

The intensity of application, which all his various and complicated employments required, probably shortened his days, as the number

of his undertakings, in some degree, impaired his usefulness. He fell into a kind of chronic fever, which, after continuing some years, with little intermission, at length wore out his frame, and put a period to his life, on September 27th, 1772, in the fifty-sixth year of his age. He died at Turnhurst, in Staffordshire, and was buried at New Chapel, in the same county.

In appearance and manners, as well as in acquirements, Mr. Brindley was a mere peasant. Unlettered and rude of speech, it was easier for him to devise means for executing a design, than to communicate his ideas concerning it to others. Formed by nature for the profession he assumed, it was there alone that he was in his proper element; and so occupied was his mind with his business, that he was incapable of relaxing in any of the common amusements of life. As he had not the ideas of other men to assist him, whenever a point of difficulty in contrivance occurred, it was his custom to retire to his bed, where, in perfect solitude, he would lie, for one, two, or three days, pondering the matter in his mind, till the requisite expedient had presented itself. This is that true inspiration, which poets have almost exclusively arrogated to themselves, but which men of original genius, in every walk, are actuated by, when, from the operation of the mind, acting upon itself, without the intrusion of foreign notions, they create and invent. A remarkably retentive memory, was one of the essential qualities brought to his mental operations. This enabled him to execute all the parts of the most complex machine, in due order, without the help of models or drawings, provided he had once accurately settled the whole plan in his mind. In his calculations of the power of machines, he followed a plan peculiar to himself; but, indeed, the only one he could follow, without instruction in the rules of art. He would work the question some time in his head, and then set down the result in figures; then taking it up in this stage, he would again proceed by a mental operation to another result; and thus he would go on by stages, till the whole was finished, only making use of figures to mark the several results of his operations. But though, by the wonderful powers of native genius, he was thus enabled to get over his want of artificial method, to a certain degree, yet there is no doubt, that when his concerns became extremely complicated, with accounts of various kinds to keep, and calculations of all sorts to form, he could not avoid that perplexity and embarrassment which a readiness in the processes carried on by pen and paper can alone obviate. His estimates of expense, have, generally, proved wide of reality; and he seems to have been better qualified to be the contriver, than the manager of a great design. His moral qualities were, however, highly respectable. He was far above envy and jealousy, and freely communicated his improvements to persons capable of receiving and executing them; taking a liberal satisfaction in forming a new generation of engineers, able to proceed with the great plans, in the success of which he was so deeply interested. His integrity and regard to the advantage of his employers, were unimpeachable. In fine, the name of *Brindley* will ever keep a place among the small

number of mankind, who form eras in the art or science to which they devote themselves, by a large and durable extension of their limits.

On an improved mode of preparing and employing Wood-Screws. By Mr. John Ford, *Mechanist.*

It is well known that the points of wood-screws, are generally terminated by the thin shell of the worm; now this, especially in hard wood, frequently turns or yields, so as, in fact, instead of merely penetrating the wood, and leaving a thin screw-like passage for the worm of the screw, that blunted end bores a groove as wide as its own increased thickness, and thus considerably affects the firmness of the screw in the wood. Now, instead of this, Mr. Ford files the points of his wood-screws into a conical form, thus entirely removing that hurtful thin shell of the worm, and he also prepares another of the same sized screws, so as to serve the office of a tap, to open the hole in a screw-like manner; and he thus greatly facilitates the entrance of the screw itself into the hole afterwards. This he effects, by filing away the threads flat on four sides, into a square form, and with sharp angular edges to them; and also flattens or spreads the conical screw head broad, so as to serve to turn the tap so formed, more conveniently than if it had been left of its original conical shape.

In using wood-screws endways of the grain of the wood, and particularly when the screws are to be frequently put in and taken out again, Mr. Ford finds this practice eminently useful; and that now we have published it, we have no doubt that it will be frequently adopted in practice. [*Tech. Rep.*

An account of the improved modes of working hard Wood, Cast-Iron, Brass, &c. into shape; practised by Mr. John Ford, *Engineer. By* Thos. Gill, Esq.

Mr. Ford, who has frequent occasion for making models for casting from, in Spanish mahogany, or other hard as well as soft woods, has found that he can make much greater despatch in working it into shape, by employing the broader part of a coarsely toothed key-hole saw, about six inches long, and mounted in a handle, than by using rasps as usual; as every tooth of the saw, in the manner he uses it, cuts away a stripe of the wood, like the grooved and toothed plane-irons used for hard woods, and it never clogs, as the teeth of rasps always do.

In using this saw, he lays it nearly flat upon the wood, but with its back a little raised, and its toothed edge resting upon the wood; he then takes the end of the saw between the thumb and fingers of

his left hand, his right hand grasping the handle of the saw, and carries it rapidly from the point to the heel, across the face of the wood, and back again; at the same time, also, moving its edge sideways, or obliquely to the right and left, and frequently crossing the strokes, or working the saw in the reverse directions, backwards and forwards over the surface he is working upon. In this curious mode of employing the saw, it is wonderful to see the despatch he makes. The higher he raises the back, the more rank, or coarse, the saw cuts; and, on the contrary, the nearer the blade is towards a horizontal posture, or flat upon the work, the smoother it works. And he can thus, from practice, work exceedingly true with it.

We have, formerly, noticed Mr. Ford's curious mode of removing the outer hard crust from iron castings, by employing a coarse round file, termed a rat's tail file, much in the same manner as he here uses a saw on wood, but occasionally turning the file to a fresh part of its surface, when it had become dull from the wear of the hard iron and sand upon it. In this way, he very soon got through the hard crust, and down to the softer and inner part of the casting, when he worked it in the usual manner, but with much greater neatness and precision than is usually effected on cast-iron. He also clears away the scale on forged iron and steel, in the same manner.

We have, in the preceding article, noticed Mr. Ford's improved mode of finishing the points of, and using, wood-screws. Mr. Ford also employs a cast-iron strike-block, or plane, in truly finishing the flat surfaces of his wood work, and with great advantages over the usual wooden planes, however well they may be made. He has fitted an upright wooden handle upon the end of the strike-block, and another upon the wedge of the plane-iron, and which he finds greatly conduce to the ease of working with it. We can, with great confidence, recommend this mode of employing the cast-iron strike-block, upon the harder kinds of wood, as well as upon the brass, gun metal, or cast-iron surfaces, it is usually employed upon, and with so great an advantage, in point of truth and accuracy.

Mr. Ford produces a beautiful surface upon his cast-iron, steel, and brass works, by means of emery sticks, and others coated with crocus; and which he prepares in the following superior manner:—

He usually mixes drying linseed oil, in the proportion of one-eighth part, with his glue, and with this he coats the surfaces of pieces of soft yellow pine, fir, or deal, without turpentine or knots, which are about eight inches long, and five-eighths of an inch square, and are nicely planed smooth. He first lays on a coat of thin glue, and when that is dry, another composed of glue mixed with the emery or crocus, and then instantly sifts over the wet surface, the emery, or crocus, in powder, by means of a sieve. He employs emery of different degrees of fineness, and has sticks thus coated with each, to be used in succession, to smoothen the work; and, lastly, uses those coated with glue and crocus, to give the finishing polish to it.

These emery and crocus sticks, are very durable, and are equally useful, to be employed on works in the lathe, as well as upon flat surfaces, and are greatly superior to the glass, or emery, papers ordi-

narily used; and infinitely so to the employment of emery mixed with oil, and applied upon sticks in the common way of doing it. He usually removes the angles, for about three inches at one end of the stick, to round it and make it serve as a handle to hold it by; and coats only the other five inches with the emery or crocus. He, also, when they are become quite dry, as at the end of nine or ten days' time, rubs them over with sweet oil. He also, occasionally, uses oil with them, in smoothening his work, in the same manner as in using smooth files. He also, sometimes, makes the pieces of wood broader than as above stated, for particular purposes. [*Ib.*

On the Manufacture of Iron and Steel (Wootz) in India: from "A Journey from Madras, through the countries of Mysore, Canara, and Malabar." By Francis Buchanan, M. D.

[Continued from page 398, of Vol. 5.]

Near Chin'-náráyan'-durga, the country, for the most part, consists of a rugged valley, surrounded by hills; but the fields between the rocks were formerly cleared, and well cultivated, the rock enabling the soil to retain moisture. Among these rugged spots, the Amildar and myself visited some iron and steel forges, which had, indeed, induced me to come this way. The information procured on the subject, is as follows:

Iron is smelted in various places of the following *talues*, or districts; Madhu-giri, Chin'-náráyan'-durga, Hagalawadi, and Dévaráya-durga. In the first two districts, the iron is chiefly made from the black sand, which the small torrents formed in the rainy season, bring down from the rocks. In the two latter districts, it is made from an ore, called here, Canay Callu, which is found on the hill Kindala Guda, near Muga-Náyakana-Cotay, in the Hagalawadi district. A little of the same iron ore, is, also, procured from a hill, called Kaymutty, near Muso-conda, in the district of Chica-Náyakana-Hully.

The manner of smelting the iron ore and rendering it fit for the use of the blacksmith, is the same here as near Magadi. The people belonging to the smelting-house, are four bellows-men, three men who make charcoal, and three women and one man who collect and wash the iron sand. They work only during the four months in which the sand is to be found; and for the remainder of the year they cultivate the ground, or supply the inhabitants of towns with fire-wood. The four men relieve each other at the bellows; but the most skilful person takes out and manages the working of the iron, and builds up the furnace; on which account his allowance is greater. In each furnace, the workman puts first a basket (about half a bushel) of charcoal. He then takes up as much of the black sand as he can lift with both his hands joined, and puts in double that quantity. He next puts in another basket of charcoal, and the fire is urged

with the bellows. When the first charcoal that has been given burns down, he puts in the same quantity of sand, and one basket of charcoal; and does this again, so soon as the furnace will receive a farther supply. The whole quantity of sand put in at one smelting, measures six hundred and seventeen cubical inches, and weighs, when dry, about forty-two and a half pounds avoirdupois. This gives a mass of iron, which, when forged, makes eleven wedges, each intended to make a plough-share, and weighing fully one and eighty-two one-hundredths of a pound. The workman here, therefore, procure from the ore, about forty-seven per cent. of malleable iron; but, as usual in India, their iron is very impure.

In the forging house, are required three hammermen, one man to manage the forceps (the tongs,) two bellows-men, and four men to supply charcoal, which, for this purpose, is always made of the bamboo. Every day three furnaces are smelted, and thirty-three wedges forged. The workmen are always paid by a division of the produce of their labour; and every fourth day, or when one hundred and thirty-two pieces have been prepared, the division is made as follows:

	Pieces.
To the proprietor - - - - - -	35
To the *panchála*, who is the foreman at the forge -	10
To the foreman at the smelting-house - - -	8
To one of the bellows-men, who removes the ashes and dross	5
To two of the women who wash the sand, at five pieces each	10
To the remaining sixteen persons, at four pieces each -	64
	132

The *panchála*, or blacksmith, out of his wages, is bound to find all the iron instruments, such as the anvil, the hammers, and the forceps. The proprietor defrays all the other expenses; and these are

	Fanams.
To the keeper of the forest, for permission to make charcoal	100
To the *gauda* or chief of the village, for leave to gather iron sand	40
To ditto, for furnace rent - - - -	15
To the *sunca*, or collector of customs - - -	30
To two pair of bellows for the smelting-house - -	42
To ditto for the forge - - - - - - -	24
To sacrifices - - - - - -	15
To charity for the bráchmans - - - - -	10
	Fanams 276

The buildings are so mean that they go for nothing; and at the beginning of the season, are put up by the workmen in the course of a day.

The stone ore is made into iron, exactly in the same manner; the quantity put into the furnace, and the produce, being nearly the same. The iron from the stone ore, is reckoned better for all the purposes to which malleable iron is applied, but it sells lower than

the iron made from the sand; for this last is the only kind that can be made into steel. The stone iron sells at six pieces for the fanam; and the people who work it are paid by daily wages. The wedges that it forms, are larger than those of the sand-iron, and weigh from three to four *seers* each; so that this iron costs about 6*s*. 10*d*. a hundred weight. The iron made from the sand, sells at four pieces for the fanam, or about 10*s*. 4*d*. a hundred weight; the pieces weighing, according to estimate, only three *seers*. I am inclined, however, to think, that, on an average, they weigh at least a tenth part more; but it would be difficult to ascertain this, as the pieces differ considerably in size, and are never sold by weight.

It must be evident, that in this account the head-man, wishing to conceal his profit, deceived us. For thirty dividends can only take place in the course of four months; and, each dividend giving him thirty-five wedges of iron, he will receive, in all, one thousand and fifty pieces, which, at the usual price, are worth only two hundred and sixty-two and a half fanams; so that in the course of the year, his expenses being two hundred and seventy-six fanams, he would lose thirteen and a half fanams, whilst the lowest workman gets monthly, seven and a half fanams, or about five shillings, which is more than is earned by the common labourers of the country. The point on which I think he attempted to deceive, was in the number of days the people wrought. If they smelted every day in the year, his profits would be very great; but allowing for many interruptions, owing to the avocations of agriculture, and to occasional deficiencies of sand, we may safely suppose that the forge is employed six months in the year, and then the profits of the proprietor will be about one hundred fanams, which is nearly in the same proportion to his stock, as the gains of the breeder of cattle are to his property. At this rate, the quantity smelted in each set of works, taking my estimate of the weight of each piece, will be about one hundred and six hundred weights; and the nineteen forges, stated in the public accounts to be in this district, and that of Madhu-giri, will yearly produce about one hundred tons of iron, worth nearly one thousand pounds.

For making steel, there are in this vicinity, five forges; four in this district, and one in Déva-Ráya-Durga. To enable the workmen to give them a supply, the merchants frequently make them advances, for almost the whole is exported. It is used for making stone-cutters' chisels, sword blades, and the strings of musical instruments. The furnace (see Figs. 1 and 2) is constructed in a hut *a*, and consists of a horizontal ash-pit, *b*, and a vertical fire-place, *c*, both sunk below the level of the ground, *d*. The ash-pit is about three-quarters of a cubit in width and height, and conducts from the lower part of the fire-place, to the outer side of the hut, where it ends in a square pit, *e*, in which a man can sit, and with a proper instrument draw out the ashes. The fire-place is a circular pit, a cubit in diameter, and descends from the surface of the ground to the bottom of the ash-pit; and at a little distance from the mouth of the fire-place, in order to keep the workmen from the sparks and the glare of the fire, is erected a mud wall, *f*, about five feet high.

Through the bottom of this, passes an earthen tube, *g*, which conducts into the fire-place the wind of two pairs of bellows, *h*. The bellows are, as usual, supported on a bank of earth, *i*, and consist each of a bullock's hide; they are wrought, as in other places of this country, by the workman passing his arm through a leather ring.

Fig. 1.

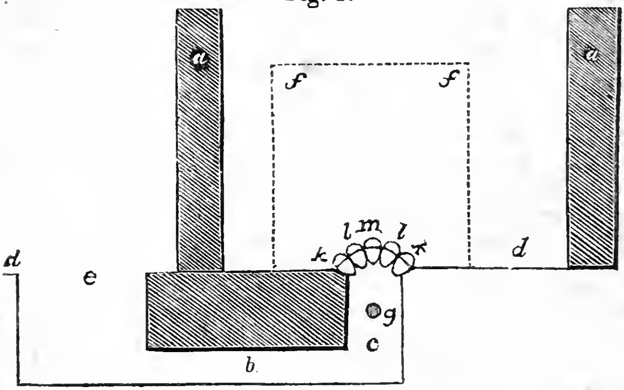
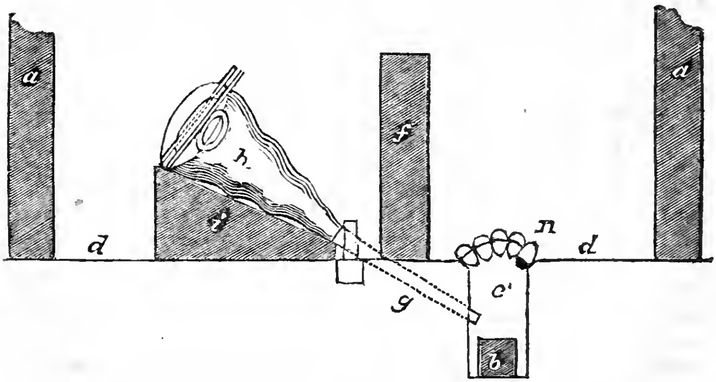


Fig. 2.



The crucibles are made in a conical form, of unbaked clay, mixed with the husks of rice well incorporated together, and each would contain about a pint of water. In each is put one-third of a wedge of iron, with three rupees weight (five hundred and thirty-one grains) of the stem of the *tayngada*, or *cassia auriculata*, and two green leaves of the *hunginay*, which is, no doubt, a *convolvulus*, or an *ipomea*, with a large smooth leaf, but never having seen the flower, I could not, in such a difficult class of plants, attempt to ascertain the species. The mouth of the crucible is then covered with a round cap of unbaked clay, and the junction is well luted. The crucibles, thus loaded, are well dried near the fire, and are then fit for the

furnace. A row of them, *k*, is first laid round the sloping mouth of the fire-place; then, within these, another row is placed, *l*, and the centre of this kind of arch is occupied by a single crucible, *m*, which makes in all fifteen. That crucible in the outer row, *k*, which occupies the place opposite to the nozle of the bellows, is then taken out, and in its stead is placed horizontally, an empty crucible, *n*. This the workman, who manages the fire, can draw out when he pleases, and throw fuel into the fire-place. The fuel used, is charcoal, prepared from any kind of tree that grows in the country, except the *ficus bengalensis*, and the *chloroxylon dupada* of my manuscripts. The fire-place being filled with charcoal, and the arch of crucibles being covered with the same fuel, the bellows are plied for four hours, when the operation is completed. A new arch of other crucibles is then constructed, and the work goes on night and day; five sets, of fourteen crucibles each, being every day converted into steel. When the crucibles are opened, the steel is found melted into a button, with evident marks, on its superior surface, of a tendency to crystallization; which shows clearly that it has undergone a complete fusion. It is surrounded by some vitrified matter, proceeding from the impurities of the iron, and, probably, nearly equal to the quantity of carbon absorbed from the sticks and leaves shut up in the crucible, for the steel in each crucible is, by the workmen, reckoned to weigh one and a quarter *seer*. These buttons, however, are never sold by weight, and those I tried, weighed very little more than one *seer* of twenty-four *rupees*. In some crucibles, the fusion is not complete, in which case, the steel is of a very inferior quality, and differs very little from the common iron.

The number of people employed at one of these works, is thirteen; a head workman, who makes the crucibles, charges them with the materials, and builds up the arch with them; and four reliefs of inferior workmen, each consisting of three persons, one to attend the fire, and two to work the bellows. Each set, therefore, in the working season, labours only four hours in the day, except every fourth day, when they must attend double that time. They are all cultivators, and in the leisure time which they have from the furnace, they manage their fields. There is, also, a proprietor, who advances all the money required, and who receives payment when the steel is sold. Fifteen pagodas' worth of iron is purchased; two for the head workman, and one for each labourer, and for the proprietor. This iron is then given to the head workman, who, for three months, is occupied in making the crucibles, loading them, and preparing the furnace. During this time, the twelve workmen bring him clay, repair the buildings, and make charcoal; but these labours occupy only intervals that could not be employed on their small fields of *ragy*. In the fourth month, when all has been prepared, they convert the fifteen pagodas' worth of iron into steel, as above described. Every man then takes the steel which his iron has produced, and the proprietor is repaid for his advances. Another quantity of iron is then purchased, and the same process is repeated; so that by each fur-

nace, forty-five pagodas' worth of iron is, in the course of the year, converted into steel. Besides the money advanced for iron, the proprietor, for the immediate subsistence of the workmen, is, occasionally, under the necessity of advancing them money; and he must also pay the general expenses attending the forge. These are,

	Fanams.
To the keeper of the forest, for leave to make charcoal	110
To the *sunca*, or collector of the customs - -	30
To the *gauda*, or chief of the village, for house rent -	15
To sacrifices - - - - - - - - - - -	30
To bellows - - - - - - - - - - - -	42
To the bráchmans, as charity - - - - - -	20
Fanams	247

Every man, however, repays his share of this, in proportion to his quantity of steel; and the whole profit of the proprietor, is the having three pagodas' worth of iron converted into steel, for which he will, in general, be in advance about forty pagodas; he, therefore, requires a capital to that extent, unless he can borrow it from some merchant, which, indeed, he generally does.

The forty-five pagodas produce one thousand eight hundred wedges of iron, and on an average produce four thousand five hundred pieces of good steel; which, at two and a half for the fanam, are equal to - - - -		Fanams 1800
Nine hundred pieces of bad steel, at six fanams - -		150
		1950
Deduct general charges - - - -	Fanams 247	
Price of iron - - - - - -	450	
		697
		Net gain 1253

The net gain, twelve hundred and fifty-three fanams, divided by fifteen, gives eighty-three fanams and a half clear profit, for each share. The workman's wages are equal to one share, and thus amount to about seven fanams a month, with double that for the foreman, because he gives up his whole time to the business. These wages are good; but the allowance for the proprietor is small, unless we consider that he, in general, gets the money from the merchant, and that his only claim for reward, is some trouble in settling the accounts, and the risk of some of the people running away with the advances made to them. Among the natives themselves, however, very little danger arises from this cause, as they are perfectly acquainted with the characters of the individuals employed.

Taking the average of the natives, of thirty rupees' weight being the true average of the pieces of steel, the quantity of steel fit for exportation, that is annually made in this vicinity, will be about one hundred and fifty-two hundred weights, and its value about 300*l.*, or 2*l.* a hundred weight.

On regulating the heat of Furnaces by means of Pyrometers, acted on by radiant heat. *By* J. M'Sweeny, M. D.

Cork, September 6, 1828.

Sir,—To measure the heat of furnaces, has been for a long time a desideratum with scientific men. The subject, latterly, has engaged considerable attention. We have the suggestions of Dr. Ure, of Mr. Daniel, and of Mr. Prinsep. To point out all the advantages that would arise from ascertaining the heat of a body at a very high temperature, would be unnecessary; the importance of the subject is allowed.

The mere practical man, who sees the great discrepancies between the experiments of Mr. Wedgwood and of Mr. Daniel, and between the experiments of the latter and of Mr. Prinsep, to ascertain the relation which the heat of a furnace bears to the scale of the thermometer, is inclined to treat with indifference these attempts; and rests satisfied either with watching the appearance of the fire to regulate the heat, or with employing, merely as a gauge, a rod of metal, which expands, and moves an index. The great objection to the use of pyrometers, at present, is, that they are liable to be injured by the action of the fire, and the bar of a gauge that traverses the centre of a furnace, is liable to be destroyed by intense and long continued heat.

The object of this paper is, to point out an instrument which may be employed by the practical man as a gauge to regulate the heat of his furnace; and which may be also used in experiments to ascertain the relation which the heat of bodies, at a high temperature, bears to the scale of the thermometer.

The instrument consists of a hollow metallic cone, open at each end, and polished inside, and one foot long; the diameter of the base is four inches. The cone is supported in the horizontal position, by small bars of wood, which rise from a board; this board serves as a stand for the instrument, by having a sheet of cork, a bad conductor of heat, fastened at the bottom. From the stand rises a case of wood, in the form of an arch, which covers the cone, but is open at each end; and the space between the surface of the cone and the wooden case is stuffed with wool, a bad conductor of heat. From the case, a delicate thermometer is suspended by thread, so that the bulb lies nearly in contact with the cone; the thermometer is kept from oscillating by other threads, fastened to different parts of the case. When a hot body is placed at a short distance from the base of the cone, it quickly raises the thermometer placed opposite the other end, by the radiant heat.

When the instrument is placed at a certain fixed distance opposite the fire of the furnace, the radiant heat of the fire will affect the thermometer, more or less, as the heat of the furnace is intense or diminished. The standard distance, is two feet from the fuel to the base of the cone; it is to be placed exactly opposite the middle of

the fire. Small boards are to be placed, one on the other, for the stand to rest on, until the desired elevation is acquired.

When a workman has got his fire at a temperature that suits his business, and is desirous of registering, by means of a gauge, the amount of heat, that he may be able to acquire it again on other occasions, he is at first to ascertain the mean temperature of the room, which may be sixty-five; he is then to place the cone at the standard distance of two feet opposite the fire, and to count the number of degrees the radiant heat of the fire raises the thermometer above sixty-five. On any future occasion, when the mean temperature of the apartment is sixty-five, he has only to place the cone as before, at the distance of two feet; and when the thermometer is raised the same number of degrees above sixty-five, as in the former experiment; the advantageous degree of heat required, is obtained. When, from the state of the weather, the mean temperature of the apartment varies, an allowance must be made for the difference. This gauge is not complicated, and is not very liable to get out of order.

In using it as a pyrometer to measure the heat of a fire as compared with a thermometer, let us suppose the mean temperature of the apartment, sixty-five; the cone, upon being used to point out the heat of a brisk fire, is placed at the standard distance of two feet, opposite a plate of iron, red hot; the thermometer will be raised above sixty-five, but will be below the degree that marked a brisk fire. If the plate of hot iron be allowed to cool, until its redness is only visible in the dark, the thermometer will indicate less heat, but greater than that of the mean temperature of the apartment. In like manner, if, at the distance of two feet, we present the side of a vessel containing boiling mercury, opposite the base of the cone, the heat indicated will be less than that caused in the last experiment. If, instead of the mercury, we now present, at the same distance, the side of a vessel containing boiling oil, the heat will be less; and a vessel containing boiling water, will cause a still lower indication by the thermometer; but yet the heat will be greater than that of the room. The excess of heat above sixty-five, is to be carefully marked after each experiment.

Thus the pyrometer is founded on the principle, that the radiant heat emanating from a hot body, will raise the thermometer, placed at a fixed distance, above the mean temperature of the room, in proportion as the body is heated; and that, as it cools, the thermometer will fall in the same relative proportion: and that the number of degrees above the mean temperature of the room, will point out the relative degrees of heat of the hot bodies subjected to experiment.

We know the heat of boiling water, as compared with the heat of boiling oil; and we know the comparative heat of boiling oil, to the heat of boiling mercury. When vessels containing mercury or oil, in a state of ebullition, are placed successively at the distance of two feet opposite the base of the cone, their relative effects on the thermometer are to be carefully marked.

In this way, we may compare the effects on the thermometer, pro-

duced by a plate of red hot iron, with the effects produced by the side of a vessel containing boiling oil or boiling mercury, and may deduce what its comparative heat is, in reference to the heat of these boiling liquids.

Surfaces of different kinds, differ in their power of radiating heat; therefore, the vessels containing the hot liquids, should be of the same kind; and the sides of the vessels, presented to the base of the cone, should be uniform in colour, and in every other respect. The hot body subjected to experiment, should be larger than the area of the base of the cone.

The great difference between experiments made with pyrometers subjected to the direct action of the fire, encourages attempts to arrive at truth, by a different road. Mr. Prinsep makes the melting point of pure silver, four hundred degrees below the determination of Mr. Daniel. The most sanguine in using pyrometers, expect only to approximate towards the real degree of heat.

What the workman is anxious for, is to keep up a steady heat that suits his business, and he will look with a friendly eye on any self-regulating apparatus, that will keep the heat of his fire from rising above, or falling below, a certain point. In a late number of the *Technological Repository*, you have given the French plan for regulating the temperature of apartments; the regulator of the fire is very ingenious; but a more delicate regulator suggests itself, in the form of an air thermometer, on a very large scale. Air, heated, expands equally; therefore, if we enclose a portion of air or gas, at a certain distance from the furnace, it will expand as the furnace is heated.

A very large air thermometer is to be made of copper; the copper bulb is to be fastened at a fixed distance from the fire; a large tube, in the form of the letter L, contains the water, which confines the air in the bulb. On the water in the tube, is a float; this float is connected, by means of a wire, with the end of a lever; the wire rises through a stuffing box at the top of the tube. The other end of the lever is connected by a rod, to the register door of the furnace. The register door turns on a horizontal axis, and is easily moved. The lever, by means of grains of shot, for which there is a receptacle provided, is kept in the horizontal position when the heat of the furnace is at the desired point. If the heat should increase, the air in the bulb expands, and the water rises in the tube; consequently, the float rises, and the opposite end of the lever descends, and shuts the register door.

If, on the contrary, the heat should decrease too much, the air in the bulb contracts, the float descends and pulls down the lever, and, consequently, opens the register door.

By regulating the heat of water circulating in tubes, the temperature of hot-houses and apartments may be kept steady for all useful purposes. You have already suggested, in a late number, a very useful application of the French plan for regulating the heat of apartments; namely, to the rearing of silk-worms in England.

I am, sir, your obedient servant,

TO T. GILL, ESQ. J. M'SWEENY.

Remarks by the Editor.—We have no doubt that some good practical results may be obtained by adopting the suggestions of our worthy correspondent. Possibly a polished concave speculum, which would collect and concentrate the heated rays upon the bulb of the thermometer, might be preferable to the cone. [*Tech. Rep.*

Experiments on the Pressure of the Sea, at considerable Depths. By JACOB GREEN, M. D. *Professor of Chemistry, in Jefferson Medical College, Philadelphia.*

AMONG the various expedients resorted to for the purpose of relieving the tedium and monotony of a sea-voyage, no one is more common during a calm, than to attach to a long line (the log) an empty bottle, well corked, and then to sink it many fathoms in the sea. In all such experiments it is well known, that the bottles, upon being drawn up, are either full, or are partially filled with water. The manner in which the water gets into the bottle, is, in some instances, perfectly obvious, but in others very perplexing, if not wholly inexplicable. Sometimes the cork, however well secured and sealed, is driven into the bottle, and, when drawn up, the vessel is of course, found filled with water; and in such cases, what is a little surprising, the cork is often found occupying its original position in the neck of the vessel, being forced there, no doubt, by the expansion of the dense sea-water, on being drawn near the surface. This seems to be proved by the cork being often in an *inverted* position. In the above experiment, and in some others to be mentioned presently, the bottle appears to be filled instantly; as the person who lowers the bottle, often feels a sudden increase of weight, somewhat similar to the sensation produced, when a fish takes the hook on a dipsey line.

Sometimes the above experiment is varied, by filling a vessel with fresh water, which, on examination, is found to be replaced by salt water; the cork remaining, apparently, undisturbed.

Sometimes, when the previously empty bottle is only half full of water, this, when poured into a tumbler, effervesces like water highly charged with carbonic acid gas. This is readily explained: for when the bottle descends, it is full of air, and when the water enters, it will, of course, absorb the air; especially when the dense water itself expands as it is drawn towards the surface.

Sometimes the experiment is performed by first corking the bottle *tight*, and then tying over the cork a number of layers of linen dipped in a warm mixture of tar and wax; in fact, every device seems to have been tried to prevent the entrance of the water by the cork. In many of these cases, when the bottle is drawn up from a depth of 200 or 300 fathoms, it is found filled, or nearly filled with water, the cork sound, and in its first situation, and the wax and tar unbroken. Two experiments are mentioned, in which ves-

sels with air-tight glass stoppers were used. In one case, the bottle was broken, and in the other, some drops of water were found in it.

How does the water find its way into the bottles? There are two opinions: one is, that it passes through the cork and all its coverings, in consequence of the vast pressure of superincumbent water, in the same manner as blocks of wood are penetrated by mercury, in the pneumatic experiment of the mercurial shower. The other, and less popular opinion, is, that the water is forced through the pores of the glass.

The following experiment, which I made on the 7th of May, 1828, in latitude 48 + longitude 24° 34', will, perhaps, throw some light on this subject.—Mr. Charles Dixey, the obliging and intelligent master of the packet-ship Algonquin, had a boat rowed off from the ship, for me, to the distance of about half a mile, when the sea was almost perfectly calm. A hollow glass globe hermetically sealed, which I had previously prepared in Philadelphia, was then fastened to a line, and sunk, with a heavy mass of lead, to the depth of 230 fathoms, or 1380 feet. On the same line, and 30 fathoms above the glass globe, was fastened a small bottle with an air-tight glass stopper; 50 fathoms above this, a stout glass bottle with a long neck, was tied; a good cork was previously driven into the mouth of this bottle, which was then sealed over with pitch, and a piece of linen dipped in melted pitch, was placed over this; and when cool, another piece of linen treated in the same way, was fastened over the first. Twenty fathoms above this bottle, another was attached to the line, much stouter, and corked and sealed like the first, except that it had but one covering of pitched sail-cloth. Thirty fathoms above this, was a small thin bottle filled with fresh water, closely corked; and 20 fathoms from this last, there was a thin empty bottle corked tight and sealed, a sail-needle being passed through-and-through the cork, so as to project on either side of the neck.

Upon drawing in the line, thus furnished with its vessels, and which appeared to have sunk in a perpendicular direction, the following was the result:

The empty bottle with the sail-needle through the cork, and which came up the first, was about half full of water, and the cork, and sealing, as perfect as when it first entered the sea.

The cork of the second bottle, which had been previously filled with *fresh* water, was loosened, and a little raised, and the water was *brackish.*

The third bottle, which was sealed and covered with a single piece of sail-cloth, came up empty, and in all respects as it descended.

The fourth bottle, with a long neck, and the cork of which was secured with two layers of linen, was crushed to pieces, all except that part of the neck round which the line was tied; the neck of the bottle both above and below the place where the line was fastened, had disappeared, and the intermediate portion remained embraced by the line. This I thought a little remarkable; but, perhaps, it may be explained by supposing that the bottle was first filled by the superincumbent pressure, with dense sea-water, which expanded on being

drawn up near the surface. Had the vessel been broken by external pressure, that part surrounded with the line, ought to have been crushed with the rest.

The fifth bottle, which had been made for the purpose of containing French perfumery, or æther, and which was, therefore, furnished with a long close glass stopper, came up about one-fourth filled with water.

The hollow glass globe, hermetically sealed, which was the last, and had been sunk the deepest of all, was found perfectly empty, not having suffered the smallest change. It is, therefore, concluded, that at the depth of 230 fathoms, the water enters glass vessels through the stoppers and coverings which surround them, and not through the pores of the glass. What the effect of a pressure of 400 fathoms or more will have on the glass globe above-mentioned, Captain Dixey has engaged to ascertain for me on his return to America, if opportunity shall offer. [*Phil. Mag.*

Account of a new method of projecting Shot, discovered by Mr. Sieviere.

At a meeting at the Royal Institution in London, held on the 23d of May last, Mr. Brockedon gave some account of a new method of projecting shot, which had been discovered by Mr. Sieviere, the sculptor. Mr. Sieviere had furnished Mr. Brockedon with a report of his earliest experiments, and to some of a later date, Mr. Brockedon was an eye-witness. The discovery was accidentally made many years since, by Mr. Sieviere, who was one evening amusing himself with a pewter syringe, which he had converted into a cannon, having closed the discharging end of the syringe, and made a touch-hole. Into this cannon, he put some pinches of gunpowder, and discharged the piston from it, which fell harmless at a short distance; happening to invert the order of firing, by holding the piston, the syringe was discharged with so much violence, as to pass through the ceiling and floor into the chamber above that in which he sat. He was struck with the prodigious difference of effect produced, and immediately had a shot cast, which, in form, was like a mortar: this he fired from a solid mandrel, or bar swung upon trunnions, and capable of elevation and adjustment. His experiment succeeded so entirely, that he was induced to make a shot with radiant bars, which, though they added little to its weight, added much to its power of destruction to rigging, &c. The weight of this shot, which was of cast-iron, was 15 pounds; this was discharged through a bank of clay 6 feet thick, and fell 20 yards beyond it. When fired again, it hit point blank at a distance of 175 yards, and was buried above 3 feet in the bank; the chamber of this shot, with which a touch-hole communicated, was precisely like that of a mortar, and when it was placed for firing upon the mandrel, the shoulder of the chamber at the bottom of the calibre rested upon the end

of the mandrel. The chamber contained a charge of 1½ ounce of gunpowder. An experiment was made with a shot which weighed 25 pounds; but a charge of 2¼ ounces of gunpowder was so great as to burst it, and to throw a fragment of 5½ pounds weight, to a distance of more than a quarter of a mile. Subsequent experiments with shot of wrought and cast-iron of different forms, confirmed the fact, that shots discharged with the magazine within them, were projected with a force greatly exceeding that which the same quantity of gunpowder, applied in the usual way, would effect.

Mr. Brockedon attempted to account for this greater force, by supposing that the power usually wasted in the recoil of the gun, was added to the force by which the shot and mandrel were separated. He stated, that no recoil in common gunnery took place, until the shot had left the cannon; and offered the following proofs of this fact. It is a common practice to fire a cannon suspended from triangles: the mark against which it is directed being hit, if any recoil had taken place before the ball left the cannon, the ball must have struck some other point tangential to the circle which its point of suspension would describe. Mr. Brockedon mentioned, that Mr. Perkins, in the course of some experiments upon recoil, had fastened a loaded rifle barrel to the edge of a horizontal wheel, which moved freely upon a vertical axis; the rifle was directed, and hit the mark, though the recoil whirled the rifle and wheel round with great velocity. Mr. Brockedon illustrated this further, by supposing a boat on still water, and imagining a plank placed from stem to stern, and a man on it pushing with a pole, a bundle of hay from him along the plank, the separation of the hay from the man, could not affect the situation of the boat on the water, whilst the hay was on board; but if the hay were thrust over, the moment it became independent of the boat, the man and boat would separate from the hay, with forces proportioned to their densities.

The space required to contain the products of the combustion of gunpowder, has not been determined by careful experiments, but vaguely stated by some, at 500, by others, at 1000 times the volume of the powder; taking the lowest statement, and supposing a cartridge to be six inches long, and the length of the gun to be five feet, not more than about 10-500 of the force generated by combustion, operate upon the ball: the remaining 490-500ths are wasted upon a recoil, which, overcoming the vis inertiæ of the gun with its carriage, (which weighs between three and four tons for a 24 pounder,) will drive it back, in garrison service, against an inclined plane 18 inches, or two feet. The instant the ball leaves the gun, the recoil takes place, and the products of combustion, which remain within the gun in a highly condensed and heated state, are opposed, in their escape, by the vis inertiæ of the external air from which the gun recoils. If recoil were attempted to be explained, simply upon action and re-action, by the intervention of a force separating two bodies, whose resistances were as their densities, then the recoil would prevent any certainty of striking the point or mark against which the cannon is directed; contrary to the effect proved by firing

from triangles, Mr. Perkins's experiments, and the practice of every sportsman. The recoil, too, takes place, whether the firing be with blank or ball cartridge; if the recoil be greater with a ball, it arises merely from the resistance which this offers to the discharge, allowing time for the more complete ignition of the gunpowder, and the generation of a greater force; hence, also, the effect of a rifled barrel, and the recoil of a foul gun.

The sky-rocket illustrates, also, this theory of recoil. To increase the surface of the composition exposed to combustion, the rocket is bored conically, nearly to its entire depth, the products of this combustion are met by the atmosphere as they rush from the neck of the rocket, and recoil from the resistance; as the cone enlarges, the force increases, and accelerates the ascent of the rocket, poised and directed as it is by the rod. The difference between the effects of the rockets and the shot, is, that in the former, the force increases from the gradual but increasing surface in combustion; in the latter, the force is at once generated, and the aid to the force which separates the shot from the mandrel, is greatest at first, and, though gradually lessening, always adds something to the force of the discharge, until the air within the calibre is equalized with the atmosphere.

The father of the late sir Wm. Congreve, tried some experiments with shot fired from a mandrel; but as he bored the mandrel into which the discharge was put, and did not put the magazine in the chamber of the shot, they failed.

As the expense of trying experiments with Mr. Sieviere's engines, is too great for an individual to incur, the probability of its becoming a most destructive engine in warfare, ought to recommend it to the serious attention of government. The advantages of the lightness of the mandrel, and the unlimited weight of the projectile, are immense. When the experiment was made with the 25 pound shot, an invalid watchman carried the cannon shot and ammunition upon his head to Primrose Hill, before breakfast; and the safety of the engine to those employed in its use, may be shown in the fact, that the shot which burst did no injury to the gunner; and no mischief could happen: for if the shot burst without advancing from the mandrel, the fragments dispersed at right angles, and if with any projection, in lines resulting from the united forces, leaving the gunner in safety. The recoil of the mandrel is very small, and arises only at the moment of separation from the pressure of the gases, which, escaping from the calibre, presses upon the end of the mandrel with effect proportioned to its surface. [*Quarterly Journ.*

On the Origin of Air Balloons. By G. Cumberland.

Sir,—It is rather remarkable, that so many books having been published on the subject of balloons, and so much money expended in useless experiments, to discover a method of guiding them with

precision, no one that I know of has as yet pointed out *the origin* of the invention, which will be found, copiously detailed, accompanied by a figure explanatory, in a folio volume, dedicated to Leopold I. by *Francesco Lana*, a Jesuit of Brescia; and published by Rizzardi, of Brescia, MDCLXX. The principal part of this volume is taken up by eight chapters on the subject of telescopes and microscopes, in which he gives directions for grinding lenses, and reflectors of metal, with plans to give the true hyperbolic, elliptic, and parabolic curves, the latter of which is extremely ingenious, and shows how well all this part of the business was understood in Italy, some years before sir Isaac Newton sent in his first papers on the subject, to the Royal Society. There are twenty plates of his own engraving, in outline only, except No. 2, on which he has given a feebly shadowed representation of his favourite invention, the aerial ship, with its four balloons, its mast, and sail; but, as the book must be very scarce, it not having been noticed by either *Fontanini*, or Apostolo *Zeno*, or found in the *Floricel* catalogue, I may as well give you the title at length, which is as follows:—

"*Prodromo*—overo saggio di alcune inventioni nuove permesso all' *arte Maestra*—opera chez prepara H. P. Francesco Lana, *Breccian.* Della compagnia di Giesu, per mostrare li più riconditi principij della naturale Filosofia, riconosciuti con accurata Teorica nelle piu segnalate inventioni, ed isperienze sin' hora ritrovatè da gli scrittori di questa materia, et altre nuove dell' autore medesimo.—Dedicato alla sacra Maestra Cesarea del Imperatore Leopoldo I.—In Brescia, MDCLXX."

The book is beautifully printed in small folio, and has a preface of seventeen pages, on the subject of the state of the sciences in his day, and the necessity of adopting the experimental mode in natural philosophy. Of course, like all the writers of that period, he is verbose, but, in many respects, very interesting, and, in general, very rational and ingenious. We will now, however, lay aside all criticism, and relate what he writes on the subject of his *balloon vessel*, which is the most remarkable novelty in his book.

After having, in his fifth chapter *of mechanic inventions, to cause birds to fly through the air*, spoken of *Architus's* dove; Baptista Porta's *flying dragon;* the relation of *Aulus Gellius* in his tenth book of the Aldic Nights; *Regiomontanus's* famous *eagle*, which flew to Charles V. on his entrance into Nuremburg; *Boetius's* narration of certain copper birds, which not only flew, but sang; *Glicas's* relation of other similar birds, which belonged to the emperor Leo; and *Vamiano Strada's* account of those which *Tariano* made for Charles V. to amuse him in his retirement,—he goes on to give the rationale of such contrivances, by four different modes, all very plausible; and then, in his sixth chapter, the title of which is, *How to construct ships, which shall be sustained only by the air, and be conducted by means of a mast and sail—the practicability of which is demonstrated,* he thus proceeds—

"The human intellect is not satisfied with the above inventions, but proceeds to improve on them by a method, by which *men*, like birds, should fly in the air; and, probably, the story of *Dædalus* may not be fabulous, since we are told, as a certainty, that a person (whose name I do not remember) in our times, by a similar method, passed across the lake of Perugia, and afterwards, in attempting to alight on the ground, let himself descend with such impetuosity, that it cost him his life. No one, however, has, hitherto, thought it possible to fabricate a ship to pass through the air, as one does that is sustained by the water, since it has been judged to be impossible to construct a machine lighter than the air itself, which would be necessary to produce the desired effect.

"Hence, I, whose genius ever led me to recover difficult inventions, after long study, conceive that I have obtained my object of constructing a machine lighter than air, which, not only by its own levity, can sustain itself in air, but be capable of supporting men, and any given weight; neither do I fear to be deceived, since the whole can be demonstrated by certain experience, and by an *infallible demonstration* from the 11th book of *Euclid*, received as such by every mathematician. Let us, therefore, lay down certain propositions, from whence may be deduced a practical method of fabricating such a vessel, which, if it does not merit, like that of Argus, to be placed among the stars, will, of itself, be able to sail towards them."

He then proceeds to describe in what manner he found the weight of the air, by a method then in use, and which is, afterwards, more fully detailed, when describing the practical part of his machine; and after going through a long series of calculations, founded on the principles laid down by *Euclid*, in his 11th and 12th books, to prove that the superfices of a ball or sphere, increases in the duplicate ratio of its diameter,—as, for example, that a globe whose diameter is double that of another—say, one of one foot, and another of two—the superfices of the globe of two feet, will be four times as large as that of one, and that the solid body of the globe, if two feet increased in a triplicate proportion, will be eight times as large, and, consequently, eight times as heavy as a globe of one foot diameter; so that the superfices of the larger, over the smaller, will be as four to one, and the solidity, as eight to one. All of which may be easily proved by experience, of which he gives numerous examples in his own experiments with glass globes filled with water, or divested of the air; and then proceeds to calculate, to what dimensions *copper globes* may be made, light enough to weigh less than the air they are capable of containing; and comes to the conclusion, by figures, that they may be conveniently made to contain 718 lbs., and that when the air is extracted, they will weigh 410 lbs. $\frac{1}{4}$ oz. less than before, and, consequently, be capable of lifting two or three men. His method of procuring the vacuum, is as follows:—he fills his globes of copper, resting on a stage, with water, by means of a plug at the top, and, by opening a stop-cock, lets it out through a *long* tube, into a vessel of water below, and, unscrewing the tube,

his globe is in a condition to ascend, but is restrained by cords; and four or more of these globes are bound together, according to the weight of the vessel to be elevated from his *balloon;* to which is attached the boat, furnished with a mast and sail, capable of being turned in any direction, which is to be accommodated with an anchor, also, when proposed to be stationary.

And now, says the author, "I can hardly help smiling to myself, to think that it seems to be a fable not less incredible than that which issued from the voluntary and wild fancies of the head of Lucian; while, on the other hand, I know that I have not erred in any of my proofs, having conferred on the subject with numerous well-informed men, who could not discover any errors in my calculations, and who only desired to behold the experiment, and see the vessel ascend; which I would willingly have gratified them with, previously to publishing my invention, *if the religious poverty I profess, had permitted me to expend one hundred ducats, which would be more than enough to satisfy a curiosity so agreeable.* Hence, I must request any of my readers who may be induced to try this experiment, to favour me with an account of their success; since, should any errors be committed in the operation, I may be able to correct them; and, in order to incite others to the trial, I will here resolve such difficulties as may be opposed to the practical operation of this discovery."

He then proceeds to state a safe mode of exhausting the air; and remarks, that some persons may suppose that, from the violence of the rarefaction, the balloon may either be broken, or so bent, as to destroy its rotundity; but, in answer to this objection, he replies, that the globes, being perfectly spherical, the air will compress every side alike; so that it is more likely to strengthen, than collapse them, as his experience taught him with glass globes, which, when not round, were easily destroyed by the egress of air; but when perfectly so, then they resisted all pressure. Next, he proposes, in order to be secure of this form, that they shall be constructed, first, as two half globes, and then soldered up as one balloon. Again, with respect to the question as to what height this vessel may ascend, since, if they could be raised to the surface of our atmosphere, it naturally follows that the men in it would not be able to respire?—to this he replies, that it could only be supported at a certain height, where the atmosphere was sufficiently dense to sustain it, and that she may be loaded according to the altitude intended to sail in; and would have the power to decline, by merely opening the key of the valve, so as to introduce a certain quantity of common air, and thus they could, at any time, descend.

Again, it might be objected, that she could never sail in any fixed direction, as ships do, who have a resistance from the water; but, says the author, "although air does not resist like water, it still makes some resistance, and if it has less than water, there is less to overcome in sailing; and, as there is always some wind, however weak, there will, probably, be always enough to propel the vessel; and with respect to its being contrary to the course they mean to

keep, he has a contrivance to allow the mast to rotate with its sail in all directions."

Lastly, it may be objected, says he, that it will be difficult to overcome the violence of the wind, which may drive them against the mountains—those formidable rocks in this ocean of air, which might overset them; but here, like all sanguine inventors, he finds an easy answer, which is, that the four globes being above the navigators, they must always be a counterbalance, and until atmospherical air is let in, they need never fear to touch the earth.

"And now," says he, "I can see no other difficulty to putting in practice this invention, except one, which is greater than all the rest; and that is, that God would never permit such a machine to succeed in practice, as it would disturb the civil and political government of the world! For who does not see that no city would be secure from surprise, as these vessels would have the power to place themselves directly over their public places, and thus enter them?" And here he gets heated with horror of the fatal consequences of his new invention, and talks of their cutting ships' cables, throwing down darts, and burning navies, by artificial fires and balls, bombs, &c. killing men, and destroying cities and castles, since, by their height, they might contrive to precipitate mischief on others, whilst they remained secure themselves." In a word, the good friar, like Uncle Toby, seems really alarmed, at last, with his own discovery; and I should not wonder if the scarceness of his folio was occasioned by his withdrawing it from general view, at last, lest he should be the author of so much mischief to mankind. [*Ib.*

Abstract of a Memoir read before the Wernerian Society, giving an account of Experiments directed to ascertain the Principles of Attraction and Repulsion in the Lunar Rays, &c.; a Description of several Varieties of the instruments constructed for that purpose; and some Applications of the Observations made, as illustrative of other Subjects. By MARK WATT, ESQ. Member of the Wernerian Society, &c.

THIS paper commenced by some remarks on the unsuccessful attempts that had been made, to determine whether the lunar beam had any calorific properties or not. And, laying this subject altother aside, the author considered it more probable, that he might succeed in exhibiting, with sufficient certainty, the attractive influence of the moon; a principle which it was generally acknowledged to possess, from the coincidence of its monthly revolutions, with the flux and reflux of the sea. The received calculation also being, that the attractive power of the moon upon our globe, when contrasted with that of the sun, was as 10 to 3, from her greater approximation to the earth.

The different forms of the instrument used for making observations on the attracting and repelling powers of different degrees of light, were constructed on the same plan, with a view to the greatest specific lightness, and the least possible friction, that *motion* might be produced by the most delicate impulses of light.

About 6 inches of the opaque part of the quill of any feather of a suitable size, was used as a balancing bar, which was made to revolve on a fine steel point, by means of a small agate capsule inserted into an aperture made in the quill, at about $\frac{1}{3}$d of the length of the bar from the point to which the disks were attached. No fixture was used for the cap, the elasticity of the medullary part of the quill holding it with sufficient firmness. The disks being affixed to one extremity of the quill, were balanced by any small weight at the other, and they traversed like a compass-needle.

The following substances were tried: A circular piece of dark coloured velvet, about 4 or 5 inches diameter, stretched on small quills; having 25 grains weight of magnetic steel-filings rubbed over its surface. Two, or four, of the illuminated tops of the smaller caudal feathers of the peacock (Pavo cristatus), with their dingy sides (which are little attracted by light) applied to each other, formed another kind of disk. Their planes were placed perpendicularly, and they were stuck into the end of the revolving quill. They were formed into a convenient size, by cutting off the straggling filaments of the feathers. One disk was made of gold, and another of silver leaf. They were formed by bending a piece of very fine silver-wire, of about the thickness of a hair, into a circle of three or four inches diameter. The wire, after being attached by its edge to the end of the quill, was wetted by a little water, in which a small portion of gum arabic was dissolved. The circle was placed upon a leaf of the gold or silver which adhered to the wire, and the corners of the leaf were then cut off.

The other substances were gold-beaters' skin; very thin paper, coated with lamp-black; and thin laminæ of mica.

All these were successively put under a hemispherical glass-cover, placed upon a marble slab, and secured from any current of air, by being surrounded at the edge by a layer of wax or putty. The effect of light was also tried upon them under the exhausted receiver of an air-pump.

Effects of the Light of a Candle.—The first experiments made upon these bodies, to ascertain in some measure how far they were affected by the attracting or repelling influences of light, were by the flame of a candle; all other sources of partial light or heat being excluded.

The velvet disk, with the steel-filings, rendered magnetic, moved to the light of a candle at the distance of 1 foot from the edge of the cover. It turns its edge to the source of light, and consequently its plane nearly parallel to the rays.

The disks made of the feathers were moved by the candle at the distance of 3 and 4 feet, measuring from the flame to the point of suspension. A broad caudal feather of any of the gallinaceous tribe,

if suspended by a fine filament of silk from the top of the cover, and balanced horizontally, with its flat sides opposite to the sides of the cover, will indicate the attractive power of the light at the distance of from 4 to 6 feet. They also traversed 5° either way to the influence of a powerful horse-shoe magnet, when placed so as to rest against the glass, the hand being quickly withdrawn.

The feathers generally begin to move slowly; in a few seconds they uniformly turn the points of their filaments toward the source of light, their sides being parallel to the direction of the rays; and whenever they assume this relative position, they rest. If the flame is placed opposite to the tips of the feathers at once, they move little, or not at all. If the rays of light are made to fall upon their planes, at angles of 40°, 90°, or 150°, they will traverse only to the extent of these degrees, and then remain stationary.

The gold-leaf, for the first hour or two after it is formed into a disk, and put under the cover, shows extraordinary sensibility to the influence of light. It indicates the effects of the light of a candle at the distance of from 15 to 20 feet from the flame. If not kept in the dark, and *in vacuo*, it soon loses this susceptibility; and, in six or eight hours, will not move at a greater distance from the flame than two feet.

The gold-leaf always turns the edge of its disk to the light, in whatever position the candle may be placed.

The silver-leaf is equally sensitive to the impules of light, and never loses this property to the same extent as the gold. If thoroughly dry, and placed *in vacuo*, it indicates the influence of light, when 20 and 25 feet distant from the flame of a candle. Several of the leaves tried, whether kept *in vacuo* or not (if preserved from the light,) when exposed to the attractive and repulsive properties of the rays issuing from the flame of a candle, always moved toward the light, at a distance of eight and ten feet. The silver-leaf has a movement peculiar to itself. It first turns the front of its disk, and then its edge; and this movement is often so constant that it will oscillate for hours in an arc of 90°. When it has lost part of its susceptibility to the impressions of light, it is so attracted as to move till its disk *confronts* the source of the light. In this state, it loses its vibratory motion, and takes a minute or two to traverse 45°.

The gold-beaters' skin moves at the distance of six feet from the flame. It turns its edge to the point from which the light emanates, and then rests.

Very thin paper, coated with lamp-black, or gilded with gold or silver-leaf, and varnished with spirit of turpentine, when the disk is about five inches diameter, moves, by the influence of the light of a candle, at the distance of three and four feet.

As the light passed through the glass of the cover, which would intercept any degree of heat, whilst it admitted the light, and as the movements begin generally in a few seconds, there is no reason to believe that any increment of heat can have any share in producing the motions.

All these bodies, however, move to the influence of heat, when it

proceeds from a *given point*, at various distances. Yet the effect of heat is evidently very inferior, in point of power, to the influence of light.

A piece of coal, for example, two inches square, ignited to a red heat, when presented to the velvet disk, with the filings, only excites it to move towards it, though held close to the cover; but if it is exposed to the clear rays of the sun, during summer, as soon as it has absorbed a certain quantity of the rays, it is strongly repelled, and will continue, when first made, to revolve for hours without intermission, performing each revolution in about 5″. They all turn their edges to the point from which the heat proceeds.

Effects of the Lunar Beam.—As the candle used in trying the effects of light on these bodies was of a moderate size, and as there appeared to be little difference between its illuminating power, at 15 or 20 feet from the flame, and the light afforded by the moon, when nearly full, it did not appear to the author unreasonable to expect, or surprising to find, that the disks were affected by the influence of the lunar rays, in nearly a similar manner. They were made the subjects of experiment both in the open air, under the cover, and in a room with the windows shut. When tried in an apartment, the window was darkened, and they were made to rest (by moving the stand a little,) in such a position that the rays of the moon, when admitted, fell upon the disks nearly at right angles to their planes. They all turned their edges toward the luminary, and their planes nearly parallel to the incidental beams; and they frequently maintained this relative position for hours, moving slowly and regularly, by following the moon's apparent course, like the shadow of the gnomon of a dial.

The silver-leaf only continued a vibratory movement, but the arcs of vibration were evidently regulated by the position of the luminary in the hemisphere.

The movements of the feathers, and of the disks made of the gold and silver-leaf, are the most constant and decided. The tips of the feathers are always attracted to the moon. And they have frequently been observed to commence their motion a few seconds after the beam has been allowed to fall upon them, in whatever angle their planes may have been resting, in relation to the incident ray. They have traversed, occasionally, 170° in a minute; and when the tips of the feathers came nearly opposite to the satellite, they stopped. It is only those feathers of the peacock that have a greenish hue when we look down upon their surfaces, that seem to be most attracted to the light of the moon. Those feathers where the bright purplish colour prevails, evince a more uncertain effect. These instruments will stand for hours in a room without moving, if placed in a situation where the beams do not impinge upon them.

These experiments have been often repeated, as opportunities occurred, for the last six months, and with every possible precaution. And there appears to be the greatest powers of attraction and repulsion in the moon's influence, from the time she has completed her first octant, till she is in quadrature or gibbous. There seems

less attraction when she is full, and this may arise from the moon's being then in opposition, and the light must be reflected from it at that time almost directly against the light of the sun; whilst, when passing through her other phases, her reflected light will cross the light of the sun at acute or right angles.

It is not mere motion that has been observed in these instruments, but a movement evidently regulated by the source from which the light is emitted.

In performing these experiments, attention must be paid to the following circumstances: The cover used should be large, thin, and purely transparent; a card should be placed in the centre of the stand, divided into quadrants and points, to mark the progress of the revolving bar; regard must be had to great specific lightness, and the disks must be kept perfectly free from damp. Care must be taken, also, that the capsule is fairly placed on the pivot, which ought to be very fine. Every source of partial light and heat ought, as far as possible, to be excluded. And the instruments must be kept covered from the light some hours before they are used, as they will not move to a subdued degree of light if they have been exposed to a greater. Their sensibilities are considerably blunted for a time, if exposed to powerful light. We must also keep at some distance from the instrument when making the trials, as the heat and electricity that escape from our bodies are a source of attraction. All these bodies are much influenced by the solar beam. But nothing yet observed, if used in *equal weights*, moves so regularly as the magnetic steel to the sun's influence, which is affected in a way peculiar to itself.

Two causes are assigned for the phenomenon, that all bodies of sufficient specific lightness, having two flat sides approaching to planes, and free to move, turn always the edges of their planes to the source of light, and their planes parallel to the line of incidence. One of the causes appears to be a sort of elective attraction, which light, like electricity, has for the points or edges of bodies. The other reason is, that all bodies kept excluded from light, are, when exposed to it, first attracted by it; and when, from their colour or opacity, they have absorbed a certain quantity of the rays, are then repelled by it. The rays of the sun evidently soon repel all the substances mentioned; and when they turn their edges, they are in that position where they receive the least possible impulse from the rays. As a vane is turned by the mechanical force of a current of air, these instruments are turned by the repelling power of the beams of light. Bodies, quite transparent, are not taken into the account. The silver-leaf is a half exception to this general law, but it is almost colourless and polished, and therefore absorbing but a small portion of the light, and quickly parting with it; it assumes a vibratory motion, first turning its plane, and then its edge, to a strong light, and thus continually moving in the arc of a quadrant. To a feeble light it stands with its plane confronting it.

The motion of the feathers seems chiefly to be occasioned by attraction. And as each filament of a peacock's feather of the size used,

has about 4000 piles upon it, each disk, at a moderate calculation, would present about a million of points to the light. These facts agree with some principles generally received, as establishing many coincidences between the phenomena of light and electricity.

Some farther observations were made on the effects of the rays of light on bodies of different forms. While bodies having planes, turned their edges towards the source of the light, and their flat sides parallel to the line of incidence, bodies of a concave shape vacillated continually in an arc of from 5° to 45°, according to the intensity of the beam of light. Bodies of a cylindrical form, crossed the line of incidence at an angle of about 25°. Transparent lenses (as of amber) keep their axes parallel with the incidental rays. And spherical opaque bodies, when nicely suspended or balanced, have the tendency to revolve continually when the beams of the sun fall clearly upon them.

Some applications were made of the phenomena described, as farther elucidating facts already known, as the attraction of the leaves and petals of plants to the light,—the formation of crystals,—the knowledge that birds and quadrupeds seem to possess of the cardinal points, as probably arising from the sensibility of their hairs and feathers to the impressions of light, electricity, and magnetism, and through them to the nervous system and sensorium. As farther explanatory of the polarity of the needle if any current of magnetism is allowed to exist, and of the diurnal variation of the pointing and dip, as dependant on the motions of the sun; and from the principle that light attracts bodies or the parts of bodies that have been in the shade, and repels that which has been for some time exposed to its influence, producing by this means a continual revolution in bodies of a spheroidal form; it is thought probable that this may be one cause of the diurnal rotation of the earth and the planets.

It has not been observed that any of these bodies indicate the electrical changes of the atmosphere; because the changes in respect to them must be general, or affecting each part of them equally. The silver-leaf, indeed, has sometimes a curious vibratory motion; but these vibrations are evidently regulated by any beam of light falling on the disk. Two of the disks suspended on two pivots, and opposed to each other, would no doubt act as an electroscope.

Jameson's Journal.

Notice in regard to the Jaculator Fish of Java, or Chætodon rostratum, Lin. By James Mitchell, Esq. Surgeon, R. N.

Whilst residing in the island of Java, in December, 1822, I heard of an extraordinary species of fish, in the possession of a Javanese chief, who lived within a mile of the town of Batavia.

Accordingly I went to see it, in company with Mr. Johnson, the commander of the ship Guilford, in which I was a passenger, and with an interpreter.

On our arrival at the chief's villa, we were treated by him with great courtesy. After conversing with him some time he permitted us to visit his gardens to see these fish, upon which he placed a high value, and would on no account part with one of them.

The fish were placed in a small circular pond, from the centre of which projected a pole upwards of two feet in height. At the top of this pole were inserted small pieces of wood, sharp pointed, and on each of these were placed insects of the beetle tribe. The placing of this pole and insects by the slaves had disturbed the tranquillity of the fish, so we had to wait some considerable time before they began their operations; but this delay was amply recompensed by the amusement they afterwards afforded us. When all had been tranquil for a long time, they came out of their holes, and swam round and round the pond. One of them came to the surface of the water, rested there, and after steadily fixing its eyes for some time on an insect, it discharged from its mouth a small quantity of watery fluid, with such force and precision of aim, as to force it off the twig into the water, and in an instant swallowed it.

After this, another fish came and performed a similar feat, and was followed by the others, till they had secured all the insects. I observed, that, if a fish failed in bringing down its prey at the first shot, that it swam round the pond, till it came opposite to the same object, and fired again. In one instance I observed one of these animals return three times to the attack before it secured its prey; but, in general, they seemed to be expert gunners, bringing down their prey at the first shot.

I was informed that these fish were originally imported from China, and are now the only specimens alive in Java, although about fifty years ago they were in possession of several of the Javanese chiefs. I could not learn their proper name; the only one that I heard was the usual term for fish made use of by the Javanese, viz. "Icon."

From the view we had of them, which was only in the water, they appeared short, about five or six inches in length, rather flat in the body, with blackish stripes variously interspersed.

The slaves of this chief fed the fish with insects regularly twice a day, in the manner I have described.

This appears to me a novel species of instinct implanted in these animals by the wise author of nature, enabling them to secure their prey, by shooting, in this manner, those insects that should happen to rest on any of the aquatic plants growing in the ponds they inhabit, and placed by their height out of their reach.

When they eject the water from their mouths, it is attended by a noise like one spitting, or squirting with a syringe.

As I had no opportunity of examining these fish, I could not say whether the fluid they squirted from their mouths was the product of secretion, or merely the water from the pond.* [*Ib.*

* The first account of this fish was published in the Transactions of the Royal Society of London, vol. liv. p. 89. It is contained in a letter to Mr. P. Collins, F. R. S. from J. A. Schlosser, M. D., F. R. S. The following is an ex-

On the Spontaneous Combustion of the Human Body.

On the 12th of May, 1828, M. Julia Fontenelle read, in the academy of sciences at Paris, a memoir entitled, *Recherches Chimiques et Medicales sur les Combustions Humaines Spontanées.*

The observations which form the subject of this memoir are highly deserving of attention. In fact, besides the interest which they are capable of exciting from their very nature, they afford a new example of one of those phenomena, the existence of which has, in these later times, been questioned, solely because, while they are very singular and difficult to be accounted for, they are also of such rare occurrence, that they can only be authenticated by an aggregate mass of evidence, which evidence, although sufficient to induce conviction, may always be rejected by those who are prejudiced, or who do not give themselves the trouble of duly estimating their value.

Are there really spontaneous combustions of the human body?

tract from the letter: "Governor Hommel* gives the following account of the jaculator or shooting-fish, a name alluding to its nature. It frequents the shores and sides of the sea and rivers in search of food. When it spies a fly sitting on the plants that grow in shallow water, it swims on to the distance of four, five, or six feet, and then, with a surprising dexterity, it ejects out of its tubular mouth a single drop of water, which never fails striking the fly into the sea, where it soon becomes its prey.

"The relation of this uncommon action of this cunning fish raised the governor's curiosity; though it came well attested, yet he was determined, if possible, to be convinced of the truth, by ocular demonstration.

"For that purpose, he ordered a large wide tun to be filled with sea-water; then had some of these fish caught, and put into it, which was changed every other day. In a while they seemed reconciled to their confinement; then he determined to try the experiment.

"A slender stick, with a fly pinned on at its end, was placed in such a direction, on the side of the vessel, as the fish should strike it.

"It was with inexpressible delight that he daily saw these fish exercising their skill in shooting at the fly with an amazing velocity, and never missed the mark."

Then follows Linnæus's description, taken from his work of the Museum of the king of Sweden, printed in 1754, where it bears the name of *Chætodon rostratum.*

In vol. lvi. p. 186, there is a farther account of the habits of this fish, in a letter from Mr. Hommel: "When the jaculator fish," he says, "intends to catch a fly, or any other insect, which is seen at a distance, it approaches very slowly and cautiously, and comes, as much as possible, perpendicularly under the object: then, the body being put in an oblique position, and the mouth and eyes being near the surface of the water, the jaculator stays a moment quite immoveable, having its eyes directly fixed on the insect, and then begins to shoot, without ever showing its mouth above the surface of the water, out of which, the single drop, shot at the object, seems to rise. No more than two different species of this fish are found here." The first is that already mentioned, as described by Linnæus, under the name Chætodon rostratum, and to which all the above refers. The other is described by Dr. Pallas, under the name of *Sciæna jaculatrix,* p. 187, of the same volume. Both species are figured.—Editor.

* Mr. Hommel, governor of the hospital at Batavia.

Such is the first question which the author examines, and he resolves it by the affirmative. Fifteen observations of spontaneous combustions, which he successively relates, enable him not only to establish the incontestible reality of the phenomenon, but also to make known the principal circumstances which accompany its manifestation. In summing up these circumstances, he remarks:

1. That persons, who have been destroyed by spontaneous combustion, have, for the most part, been immoderately addicted to the use of spirituous liquors.

2. That this combustion is almost always general, but that it may be only partial.

3. That it is much rarer in men than in women, and that the women in which it has been manifested, have almost all been aged; one woman only was seventeen years of age, and in her the combustion was but partial.

4. That the body and viscera have always been burnt, while the feet, the hands, and the top of the head, have almost always escaped.

5. Although it is demonstrated that several loads of wood are necessary for reducing a dead body to ashes by ordinary combustion, incineration is effected in spontaneous combustions without the most combustible objects placed in the vicinity being burnt. In one case there was a very singular coincidence of two persons being consumed at the same time, in the same apartment, without the apartment or the furniture being burnt.

6. It is not demonstrated that the presence of a burning body is necessary for producing spontaneous combustion of the human body; on the contrary, there is every reason to believe the reverse.

7. Water, so far from extinguishing the flame, seems to render it more active; and after the flame has disappeared, the intimate combustion continues to be effected.

8. Spontaneous combustions have appeared more frequently in winter than in summer.

9. No remedy has been found for general combustion, but only for partial.

10. Those who undergo spontaneous combustion, are the prey of a violent internal heat.

11. Spontaneous combustion developes itself suddenly, and consumes the body in a few hours.

12. The parts of the body which are not consumed by it, are attacked with sphacelus.

13. In individuals affected by spontaneous combustion, there supervenes a putrid deterioration, which presently brings on gangrene.

14. The residuum of spontaneous combustion consists of greasy ashes, and an unctuous soot, both having a fetid odour, which diffuses itself equally through the apartment, impregnating the furniture, and extending to a great distance.

The author then explains the two theories of combustion, between which, the learned world is at present divided; Lavoisier's, and that lately proposed by Berzelius. He then gives an account of the theories proposed for the explanation of the phenomenon in question.

Most authors, who have spoken of spontaneous combustions, have imagined they discovered an intimate relation between their manifestation and the immoderate use of spirituous liquors in the individuals attacked. They suppose that these liquors, being continually in contact with the stomach, penetrate through the tissues, and fill them up to saturation, in such a manner that the approach of a burning body is sufficient to induce combustion in them.

M. Julia Fontenelle, does not consider this explanation satisfactory. He founds his opinion, 1st, on the circumstance that there is no proof of this alleged saturation of the organs in persons addicted to the use of spirits; 2dly, on the circumstance that this saturation itself, would not suffice to render the body combustible,—and, to demonstrate this assertion, he gives the result of several experiments, in which he in vain tried to render ox-flesh inflammable, by steeping it for several months in brandy, and even in alcohol and ether.

Another explanation has been proposed. Dr. Marc, and with him several other physicians, from the development of hydrogen gas, which takes place in greater or less quantity in the intestines, have been led to imagine, that a similar development may take place in other parts of the body, and that the gas might take fire on the approach of a burning body, or by an electrical action produced by the electric fluid, which might be developed in the individuals thus burnt. According to this theory, MM. Lecat, Kopp, and Marc, suppose, in subjects affected by spontaneous combustion, 1. An idio-electric state; 2. The development of hydrogen gas; 3. Its accumulation in the cellular tissue.

This latter explanation would appear to be confirmed by a very curious observation of M. Bailly's. That physician, on opening, in the presence of twenty pupils, a dead body, over the whole of which there was an emphysema, which was greater in the lower extremities than any where else, remarked, that, whenever a longitudinal incision was made, a gas escaped, which burned with a blue flame. The puncture of the abdomen yielded a stream of it more than six inches high. What was very remarkable, was, that the gases contained in the intestines, so far from increasing the flame, extinguished it.

M. Julia Fontenelle, for reasons similar to those which induced him to reject the first hypothesis, is of opinion that the presence of hydrogen gas cannot be admitted as the cause of spontaneous combustion. He founds this opinion more particularly upon experiments, in which he in vain tried to render very thin slices of flesh combustible, by keeping them for three days immersed in pure hydrogen gas, in percarburetted hydrogen gas, and in oxygen gas.

Lastly, he considers the opinion equally untenable, that spontaneous combustion of the human body, is owing to a combination of animal matter with the oxygen of the air, whatever may be the alterations which this matter may undergo: 1. Because a sufficient temperature is not developed; 2. Because, admitting this combustion as real, the residuum would be a charcoal, which could only be incinerated at a red heat, while, on the contrary, there is nothing but

ashes; 3. Because one of the products of spontaneous combustion of the human body, is an unctuous substance, which the combustion of animal substances never yields; 4. Because it scarcely yields any ammoniacal products, while such are always produced by animal combustion.

After thus rejecting all the hypotheses hitherto proposed, M. Julia Fontenelle concludes that this phenomenon is the result of an internal decomposition, and is altogether independent of the influence of external agents. We give his own words:

"We consider," says he, "what are called spontaneous combustions of the human body, not as true combustions, but as intimate and spontaneous reactions, which depend upon new products originating from a degeneration of the muscles, tendons, viscera," &c. "These products, on uniting, present the same phenomena as combustion, without losing any of the influence of external agents, whether by admitting the effect of the opposite electricities of Berzelius, or by adducing in example, the inflammation of hydrogen, by its contact with chlorine, arsenic, or pulverized antimony, projected into this latter gas," &c.

It may be objected, however, that, whatever may be the cause which induces this combustion, the caloric disengaged ought to be considerable, and, consequently, should ignite all the objects in the neighbourhood. We reply to this, that all combustible substances do not by any means disengage an equal quantity of caloric by combustion. Davy has shown, that a metallic gauze, having 160 holes in the square inch, and made of wire one-sixtieth of an inch in diameter, is penetrated at the ordinary temperature, by the flame of hydrogen gas, while it is impermeable to that of alcohol, unless the gauze be very much heated. According to the same chemist, gauze of this kind, raised to a red heat, allows the flame of hydrogen gas to pass through it, without being permeable to percarburetted hydrogen gas. It is probable from this, that the products arising from the degeneration of the body, may be very combustible, without, however, disengaging as much caloric as the other combustible bodies known, and without leaving a residuum, as the two latter gases; and, in fine, we are of opinion, that, in some subjects, and chiefly in women, there exists a particular diathesis, which, conjoined with the asthenia occasioned by age, a life of little activity, and the abuse of spirituous liquors, may give rise to a spontaneous combustion. But we are far from considering as the material cause of this combustion, either alcohol, or hydrogen, or a superabundance of fat. If alcohol plays a prominent part in this combustion, it is by contributing to its production; that is to say, it produces, along with the other causes mentioned, the degeneration of which we have spoken, which gives rise to new products of a highly combustible nature, the reaction of which determines the combustion of the body.

It is to be regretted, that the observations hitherto published, are not more complete. We propose to ourselves to collect all that may tend to throw light upon a subject so important in anthropology and medical jurisprudence.

Innocuous Nature of Putrid Exhalations.

A COMMITTEE have been engaged in France, in examining the circumstances relative to the knacker's operations. His business consists in killing old worn-out horses, and turning every part of their body to account. The most singular results which the committee have obtained, relate to the innocuous nature of the exhalations, arising from the putrefying matter; every body examined, agreed that they were offensive and disgusting, but no one that they were unwholesome; on the contrary, they appeared to conduce to health. All the men, women, and children, concerned in the works of this kind, had unvarying health, and were remarkably well in appearance, and strong in body. The workmen commonly attained an old age, and were, generally, free from the usual infirmities which accompany it. Sixty, seventy, and even eighty, were common ages. Persons who live close to the places, or go there daily, share these advantages with the workmen. During the time that an epidemic fever was in full force at two neighbouring places, not one of the workmen in the establishment at Montfaucon was affected by it. It did not appear that it was only the men who were habituated to the works that were thus favoured; for when, from press of business, new workmen were taken on, they did not suffer in health, from the exhalations.

In confirmation of the above observations, similar cases are quoted: above 200 exhumations are made yearly at Paris, about three or four months after death; not a single case of injury to the workmen has been observed. M. Labarraque has observed, that the catgut makers, who live in a continually putrid atmosphere, arising from macerating intestines, enjoy remarkable health. Similar circumstances were remarked, at the exhumations of the Cimetière des Innocens.

Whatever disease the horse may have died of, or been killed for, the workmen have no fear, adopt no precautions, and run no risk. Sometimes, when strangers are present, they pretend to be careful, but, upon close inquiry, laugh at such notions. They handle diseased as well as healthy parts, *always with impunity*. They frequently cut themselves, but the wounds heal with the greatest facility, and their best remedy is, to put a slice of the flesh about the wound.

On making inquiry of those to whom the horse-skins were sent, and who, besides having to handle them when very putrescent, were more exposed to effects from diseases in the skin, they learnt that these men, also, from experience, had no fear, and never suffered injury. Horse-skins never occasioned injury to those who worked them, but in this they differed from the skins of oxen, cows, and especially sheep, which sometimes did occasion injury, though not so often as usually supposed. [*Recueil Industriel*, v. 55.

Account of the Restoration of Hair, by the use of Sulphate of Copper, (blue vitriol.)

A man between twenty and thirty years of age, of strong and healthy constitution, having a short, curly, and coarse hair, of a dark brown colour, found himself becoming bald. Numerous and large bald spots appeared on the head, and gradually increased until it became perfectly bare, and as the eye-lashes fell out, the man had quite a singular and disagreeable appearance. When the head was closely examined, a short, white, and scattered down, very similar to a slight degree of mouldiness, was perceptible. At first it was hoped, that the hair would grow again, but the sequel proved the contrary; after two years, Dr. Radimacher advised him to pour French brandy upon sulphate of copper, (blue vitriol,) and, when it had remained a few days, to wash the bald parts once a day with the solution. In eight days, the hair had begun to grow, and in four months it equalled the original growth in quantity, but was of a lighter colour, crisp, dry, and stiff, and had not a natural appearance. A spot still remained bald on the back of the head. The eye-brows and lashes grew again like the rest of the hair. A year after this, the man shed his hair again, but the eye-brows and lashes remained. Dr. R. wished him now to wait awhile, to ascertain whether the hair would or would not grow again spontaneously, but the patient would not, and had recourse to the solution, which produced another growth of bland or light hair, and the spot, which before had continued bald, notwithstanding the solution, became covered in common with the other parts of the head. This growth had a much more natural appearance than the former one. [*Med. Journ.* lix. 470.

On the Natural History of the Honey Bee, and the importance of its products.

[Extracted from the North American Review, for October last.]

The bee seems to be a native of every part of the globe, and the same characteristic traits distinguish the whole race; we allude simply to the honey bee, *Apis Mellifica.* Even in New South Wales, we find that, excepting in some variation of size and colour, the honey bee is the same with that of Europe and America. The history of one bee, and of one community of bees, is, with the slight variation which is always produced by climate, the history of the whole race; nor should we venture to add our stock of observation to the great mass of what is already known upon the subject, and accessible to every class of persons, did we not wish to excite the attention more particularly of those who inhabit the mountainous districts of this portion of our country, to this practicable and profitable branch of horticulture.

From the commencement of history, to our own day, bees have been an object of attention, honey has been used, and wax has been an article of commerce. In fact, the amount of the former consumed for food, medicine, and a pleasant beverage, and of the latter for various purposes in the arts, would astonish those who have never turned their attention to the subject. In the savage and civilized state, wherever there has been sun enough to mature a flower, every individual of the community is as familiar with the luxury of honey, and the merits and uses of bees'-wax, as with the daily food that is consumed.

Man has never been slow to appropriate to himself the physical powers of the inferior animals; but of all those which have been subdued to his use, the bee alone has preserved its independence. We ought not, in fact, to use the term *subdued*, as it does not apply to the situation or position which the bee holds among us in its domestic state. Neither its nature nor its habits are, in any wise, altered or modified. It preserves its singular economy unchanged, whether it inhabit a hollow tree in the midst of an unfrequented forest, or a hive in the centre of an apiary.

And here, we would remark, that a hive ought not to be considered as the house or habitation of the bee, for even in the forests, where there may be supposed to be abundance of hollow trees suited to their purposes, bees have built their cells on the under side of a stout branch; and they have neglected the convenient form of a well constructed hive, to attach themselves to the eaves of a house, or to the inner sides of a chimney. The nature of this part of their instinct, goes no further than to secure a *firm* roof, to which they can attach the cells, and a position that shall protect the cells from the sun and rain.

This faculty, or instinct, is sometimes at fault, for we often hear of their adopting the strangest and most unsuitable tenements for the construction of cells. A hussar's cap, so suspended from a moderate sized branch of a tree, as to be agitated by slight winds, was found filled with bees and comb. An old coat, that had been thrown over the decayed trunk of a tree and forgotten, was filled with comb and bees. Any thing, in short, either near the habitations of man, or in the forests, will serve the bees for a shelter to their combs.

If this instinct were as absolute as some persons would make us believe, the bees, when swarming, would, undoubtedly, choose a domicile, as nearly similar to the one they had left, as possible; but this is rarely the case. In their pursuit of food, with which the woods as frequently supply them as the gardens, their quick eye guides them to the places suitable for the establishment of a swarm. They do not, by a distinct succession of thoughts, arrive at the conclusion, that the hollow tree will suit them as a dwelling; but they find it unoccupied, they pass it daily, and when the whole swarm is collected on the branch of a tree, these foraging scouts, that have espied the hollow tree, run over the mass of bees as they hang, give

the signal of departure, lead the way to the woods, and the queen and the whole swarm follow to the selected tree.

But, although the bees are rarely unprovided with a retreat for a new swarm, yet they readily accept of a more obvious one, when offered. Aware of this willingness on the part of the bees, man takes the opportunity, when they are collecting their numbers, of introducing them into a hive, and of bringing them under his own immediate *surveillance*, that he may the more easily partake of the fruits of their labours. Yet, although colony after colony have dwelt in uninterrupted succession in a particular apiary, their instinct is not improved, nor their reflective powers enlarged. They are the same in all their instincts and formations, as they were, when the first observations on their habits, with which we are acquainted, were made.

We have, for seven years, had a little colony under our immediate inspection, and we began our personal observation with the knowledge of all that ancient and modern theorists have advanced, in relation to the habits, customs, and manners, of this wonderful insect. We came to their superintendence with a mind tinctured with all that was marvellous and fanciful, and with an ardour that seven years have not subdued; although theory after theory has now melted away, and most of the wonders and enigmas have been solved, and reduced to the clearest and most simple particulars. Our wonder and admiration, although deprived of the charms of the fanciful legends in which the history of the bee was embodied, are still undiminished, nay, increased; for an elevation of thought and feeling has been produced by the study.

Notwithstanding the astonishing sagacity to be traced in the economy of bees, and the diversity of habits which might be expected, nature, in reality, is less variable in this instance, than in most others; for although climate and a contracted habitation may reduce their size, and scantiness of food reduce their numbers, yet, as long as there are flowers, the bee will abstract the honey, and as long as there are forests, the bee will construct a cell. With other insects and animals, and even with man himself, the case is different. Insects will imbibe nourishment from the exudations of both animal and vegetable substances. Man can accommodate himself to every variety of diet, and thrive on all. The bee alone never changes its food. The sweet sap that exudes from vegetable pores, and which is accumulated in the nectary of flowers, serves alike to sustain the bee, and to render the seeds of plants fit for germination. As no flower can arrive at maturity without the assistance of this fluid, it is ever present; and as the bee has a two-fold duty to perform, that of preserving its own being by such means as nature has pointed out, and that of assisting the winds in carrying the pollen from flower to flower, creative wisdom has so arranged it, that the peculiar food of the bee is in abundance. And as this nutritive fluid is to support inanimate life, which requires an unvaried and uniform food, the bee for ever partakes of the same nourishment, and is

enabled to preserve its peculiarities of form and instinct unaltered, from generation to generation.

For both the operations, therefore, of sustaining life and of dispersing pollen, which require uniformity of instinct and organization, the bee is the same in all situations and in all ages. The working bees have the instinctive faculties of building different shaped cells; of choosing and preparing the food, both for the larvæ and for themselves; of taking care of the young brood; of carrying off noxious and extraneous matter; of defending themselves from enemies of *their own species;* and of expelling the drones when they are no longer of use in the hive. They have the instinctive knowledge that they cannot, as other insects do, exist individually; they are constructed, therefore, in so admirable a manner, as to make every thing subservient to the safety and comfort of the mother of the brood. She is, in their estimation, as much a part of themselves, as an eye or a limb. Their care of her is a kind of self-preservation, a law implanted in every living thing.

After rejecting all the fanciful and marvellous speculations of the theorists, there are still several material points unsettled, on three of which we propose to make a few remarks at the present time.

1st. The most modern and the most rational theorists differ in their opinions respecting the accuracy of the facts, that are stated in relation to the queen bee's leaving the hive at any other time, than when she goes forth with a new swarm.

2d. They dispute, likewise, on the possibility of the bees making a queen bee, from a neuter, when circumstances require it.

3d. They are still ignorant, whether the drones perform the office of nurse to the larvæ when deposited in the different cells.

On the first point, we venture to state unhesitatingly, that *the queen bee never leaves the hive, but when she accompanies a swarm.* For ten weeks, we fixed our attention on the entrance of two hives that stood close to each other on a bench. Our watch, either in person, or entrusted to another as interested and vigilant as ourselves, commenced at gray dawn, and continued till sunset; and never within that period did the queen bee of either hive leave them, but at the time of swarming, which occurred once in each hive during our inspection. With an eye to this single circumstance, we have, for six successive years subsequent to the careful observation just stated, been in the constant habit of noting every peculiar movement at the entrance of hives, but we never saw the queen. Independently of the reliance that can be placed on observations of this kind, we have confirmation derived from strong probabilities.

The average number of a hive or swarm, is from fifteen to twenty thousand bees. Nineteen thousand four hundred and ninety-nine are neuters, or working bees, five hundred are drones, and the remaining *one* is the queen or mother! Every living thing, from man down to an ephemeral insect, pursues the bee to its destruction, for the sake of the honey that is deposited in its cell, or secreted in its honey-bag. To obtain that which the bee is carrying to its hive, numerous birds and insects are on the watch, and an incredible

number of bees fall victims, in consequence, to their enemies. Independently of this, there are the changes in the weather, such as high winds, sudden showers, hot sunshine; and then there is the liability to fall into rivers, besides a hundred other dangers to which bees are exposed.

Can any one, who considers all these casualties, suppose, that the instinct in bees is so defective, as to allow so important a member of the community, and the only one of the kind, too, to leave the hive and run the immense risk that would attend an excursion in the air? It is a well established fact, that one queen lays all the eggs of the hive; that part of the daily duties of the working bees, is to nourish the young brood, which, if there were no queen, they could not do, as there would be no eggs. If the bees are disturbed in their regular routine of business, they become uneasy and incapable of proceeding. When they return from the nectary of flowers, with the usual quantity of sweet fluid, they hasten to bestow the first or uppermost part of honey on the larvæ and young bees; and when this simple, undigested liquid is disposed of, they deposit that which has gone through a certain chemical process, in the cells.

If, therefore, on entering the hive, they find no queen, they run about anxious and distressed, drop the little pellets of pollen that are attached to their legs, strike their antennæ against one another, and are in great agitation during the day. Sometimes two days are passed in this restless state, before they make an effort to repair their loss.

If the queen bee were to leave the hive, as Huber and others fancy, she would run great risk of never being able to return to it. Even around the apiary, before she had made the usual evolutions in the air, common to all bees on leaving the hive, she might become the prey of one of the many birds, that are hovering over head, or on the watch. The blue-bird, the king-bird, and the cat-bird, swallow bees by dozens, while on the wing; and the queen bee would have less chance of escape, as she is larger, and, therefore, more conspicuous, and is, besides, very slow and heavy in her motions, her wings being smaller, in proportion to her body, than those of the working bee and the drone.

From our own observations, therefore, as well as from the above inferences, we must believe that the queen bee *never* leaves the hive, but for the establishment of a new colony.

The next material point of dispute is, whether it be in the power of the working bees to convert the larva of a working bee into that of a queen, when by accident the hive is deprived of one. According to the most accurate naturalists, the organization of the queen, or mother bee, is different from that of either the drone or the neuters. It appears to us quite as rational and philosophical to suppose, that a queen bee could be converted into a neuter, and, therefore, that all bees, at first, were of the shape and organic structure of the queen, as to suppose that a neuter, or working bee, could have new organs added, new curves given to its limbs, and new instincts to its nature.

If we could see the interior of a hive, whenever it suited our convenience, we should not be so lost in conjecture; but the irritability of these little insects, prevents a constant and minute internal inspection. It is a part of their instinct to know, that *light*, *heat*, *cold*, and *moisture*, in an undue and unaccustomed degree, are prejudicial to the formation of wax, to the consistence of the honey, and to the health of the brood. They, therefore, use all the little arts and advantages they possess, to prevent any one from exposing them to the injurious influence of these active powers.

When a queen bee ceases to animate the hive, the bees are conscious of her loss; after searching for her through the hive, for a day or more, they examine the royal cells, which are of a peculiar construction, and reversed in position, hanging vertically, with the mouth underneath. If no eggs or larvæ are to be found in these cells, they then *enlarge* several of those cells, which are appropriated to the eggs of neuters, and in which *queen eggs have been deposited.* They soon attach a royal cell to the enlarged surface, and the queen bee, enabled now to grow, protrudes itself by degrees into the royal cell, and comes out perfectly formed, to the great pleasure of the bees.

Now this, in itself, is curious and wonderful. There is no need of adding superhuman powers to an insect, when the simple facts show such singular sagacity. The truth is, that the queen, or mother bee, lays the neuter eggs in certain cells of a particular construction; in fact, the eggs are laid, at least many of them, as soon as the foundations are begun, before the cells are built. The bees know, from the peculiar shape of the egg, that it is to have a cell of certain dimensions. When the neuter and drone eggs are deposited, the royal cells are then filled, for abundant observations prove that the queen eggs are laid last. If the royal cells are not sufficient to hold all the queen eggs, they are laid in the *common cells*, and in the course of the regular business of the hive, these cells are attended to with the rest. When the larva is of a size to fill the cell, a covering of wax is put on, and here ends the life, or rather the embryo of the queen; for no longer having room to expand, it perishes, and is dragged out in the nymph form, as soon as the bees discover that animation is extinct. If, during the progress of the egg from the larva to the nymph state, the mother queen dies, and there are no eggs in the royal cells, then the bees have recourse to the queen eggs that are laid in the common cells. By enlarging the entrance, and by attaching to it a cell, which hangs *vertically*, they continue the life of the larva, and a queen bee is formed.

Here is no work of transformation. The insect is already formed, and nothing remains to be done, but the mere mechanical operation of building a habitation, which shall be adequate to its wants. The peculiar organic construction of the queen bee, perhaps, requires a difference of food, as we perceive it does of dwelling. No doubt it is necessary to supply it more abundantly, and with greater care.

The very position it is compelled to take, shows that it requires a different kind of nurture from either the common bee or the drone.

It is wonderful that instinct is so competent to direct these changes; but it would be more than wonderful, if, in addition to this instinct, the bee had the power *to construct new organs*, as it does different cells, and thus to endow the insect with a different nature.

The third point unsettled, and which is likely to remain for ever a secret, is, whether the eggs of the queen are hatched after the manner of the eggs of fishes, whether they simply are animated by incubation, or by the care and nourishment bestowed upon them by the working or neuter bees.

On this point, experiment has proved nothing. The greatest diversity of opinion exists. There are upwards of a thousand writers on the history and policy of the bee, and yet no two have either observed or reasoned alike. Even the two distinguished naturalists, who have passed the best portion of their lives in studying bees, with equal zeal and with equal opportunity, have come to very different conclusions. Huber is by far the most circumstantial experimentalist, who has turned his attention to this subject. But his truly philosophical mind, has been rendered comparatively useless, nay, worse than useless, by the ignorance or wilful misrepresentations of his assistant, Francis Burnens. Huber could but philosophize on facts as they daily were represented to him. His solutions of things *unreal*, and having *no truth in nature*, are most ingenious and rational. Had his physical sight been as perfect as his mental vision, his work would, doubtless, have been all that could be effected by the industry and talent of man.

The naturalists of Europe, misled by his extraordinary talent, adopted Huber's notions with respect to bees, and his opinions were considered as conclusive. The public opinion became imbued with the spirit of his doctrines; and we find the greatest and acutest reasoners discussing, in perfect security, the nature of an insect, that could at one moment organize animal life, and impart to it new instincts, and in the next, construct bulwarks and other modes of defence, to protect himself from an enemy, that until the last century, never molested him.

The real fondness that was inspired for the study of the bee, by the interesting work of Huber, engaged many in the pursuit; and the very mistakes that he has made, have led to something nearer the truth. Owing to the general improvement in education, the taste for the marvellous is fast disappearing; and there are now many who set themselves down to the study with their reason unbiassed, and their judgment free to decide according to the evidence of facts.

Huish, amongst the late writers, has most successfully combatted the principal errors in Huber's theory; but, although he has fixed a base on which a rational theory may be built, his object seems less to elicit truth, than to expose the errors of Huber. This he has endeavoured to do in the most unamiable and bitter spirit, which destroys the gratification with which his book would be read by the candid inquirer. In addition to this, he has laid himself open to the charge of plagiarism. He must have studied the subject sufficiently to acquire a knowledge of the different forms of hives, that

have been in use from the earliest antiquity to his own time; and the peculiar shape of the Greek hive could not have escaped his vigilance, for drawings and descriptions of it are within the reach of every student; yet he boldly states, that a flower-pot first gave him the hint of the plan which he adopted for his own hive.

[TO BE CONTINUED.]

On the Cohesive Strength of Beams, Bars, &c.

[From Brunton's Compendium of Mechanics.]

After considering the mechanical powers which are the constituent principles of all machines, the next step is to consider the strength of the materials of which machinery is composed—this knowledge being of the greatest importance to the mechanic, by enabling him to adjust, with respect to magnitude, the various parts of the machine, that the strength of each part may be proportional to the stress it has to sustain.

The cohesive strength of a body, is that force by which its fibres or particles resist separation; therefore, the more particles that are in a body, the greater will be the power requisite to tear them asunder, according to the rule, that the strength of bodies is as the area of their cross sections.

Our knowledge in this property of bodies, is very limited, there being very few experiments made on which to build a theory, and these few do not agree.

The following are the results of experiments made by Mr. Emerson, which state the load that may be safely borne by a square inch rod of each substance.

	Pounds Avoirdupois.
Iron rod, an inch square, will bear	76,400
Brass,	35,600
Hempen rope,	19,600
Ivory,	15,700
Oak, Box, Yew, Plum-tree,	7,850
Elm, Ash, Beech,	6,070
Walnut, Plum,	5,360
Red Fir, Holly, Elder, Plane, Crab,	5,000
Cherry, Hazel,	4,760
Alder, Asp, Birch, Willow,	4,290
Lead,	430

Mr. Barlow's opinion of this table is, "we shall only observe here, that they all fall very short of the ultimate strength of the woods to which they refer." *See Barlow's Essay on the strength of Timber, Art.* 3.

Mr. Emerson, also, gives the following practical rule, viz. "that

a cylinder, whose diameter is d inches, loaded to one-fourth of its absolute strength, will carry as follows:—

	Cwt.
Iron, - - - - -	$135 \times d^2$
Good Rope, - -	$22 \times d^2$
Oak, - - - - -	$14 \times d^2$
Fir, - - - - -	$9 \times d^2$

Captain S. Brown made an experiment on Welsh pig iron, and the result is described as follows:

"A bar of cast-iron, Welsh pig, 1¼ inch square, 3 feet 6 inches long, required a strain of 11 tons, 7 cwt. (25,424 lbs.) to tear it asunder, broke exactly transverse, without being reduced in any part; quite cold when broken; particles fine, dark bluish gray colour." From this experiment, it appears that 16,265 lbs. will tear asunder a square inch of cast-iron.

Mr. G. Rennie, also, made some experiments on cast-iron, and the result was, "that a bar one inch square, cast horizontal, will support a weight of 18,656 lbs.—and one cast vertical, will support a weight of 19,488 lbs."

There have been several experiments made on malleable iron, of various qualities, by different engineers.

The mean of Mr. Telford's experiments, is 29¼ tons.
The mean of captain S. Brown's do. is 25 do.

and the mean between these two means, is 27 tons, nearly; which may be assumed as the medium strength of a malleable iron bar 1 inch square. *See Barlow's Essay, page 235.*

From a mean, derived by experiments, performed by Mr. Barlow, it appears that the strength of direct cohesion, on a square inch of

		lbs.
Box - -	is about - -	20,000
Ash - -	— - -	17,000
Teak - -	— - -	15,000
Fir - -	— - -	12,000
Beech - -	— - -	11,500
Oak - -	— - -	10,000
Pear - -	— - -	9,800
Mahogany -	— - -	8,000

These weights may be taken as correct data for the cohesive strength of the wood to which they belong; but this is the absolute and ultimate strength of the fibres; and, therefore, if the quantity that may be safely borne be required, not more than two-thirds of the above values must be used.

Transverse strength of Beams, Bars, &c.

If a beam be supported at both ends, and loaded in the middle, it will bend, (which is called deflection;) and if the load be increased, it will break, (which is called fracture.)—If a beam 2 inches deep and one inch broad, support a given weight, another beam of the same depth, and double the breadth, will support double the weight:—hence, beams of the same depth are to each other as their

breadths:—again, if a beam 2 inches deep, and 1 inch broad, support a given weight, another beam of 4 inches deep, and 1 inch broad, will support four times the weight;—hence, beams of equal breadths are to each other as the squares of their depths:—again, if a beam of a given cross section 1 foot long, support a known weight, another beam of the same cross section, but 2 feet long, will support only half the known weight:—hence, beams of equal dimensions are to each other inversely as their lengths; therefore, the strength of beams is directly as their breadths and square of their depths, and inversely as their lengths; and if cylindrical, as the cubes of their diameters.

*Practical Problems for the Transverse Strength of Timber.**

TABLE OF MULTIPLICANDS.

English Oak	1426
Canadian do.	1766
Ash	2026
Beech	1556
Elm	1013
Pitch Pine	1632
Red Pine	1341
Fir	1100
Larch	1127

PROBLEM I.

To find the ultimate transverse strength of any Rectangular Beam of Timber, fixed at one end, and loaded at the other.

Rule. Multiply the number in the table of multiplicands, by the breadth and square of the depth, both in inches, and divide that product by the length, also, in inches; the quotient will be the weight in lbs.†

Example 1.

What weight will it require to break a beam of fir, the breadth being 2 inches, depth 6 inches, and length 20 feet?

$$\frac{1100 \times 36 \times 2}{240} = 330 \text{ lbs.}$$

Example 2.

What is the weight requisite to break a beam of ash, 7 inches square, 3 feet from the wall?

$$\frac{2026 \times 7^3}{36} = 19303\tfrac{10}{36} \text{ lbs.}$$

* See Barlow's Essay on the strength and stress of timber, *Art.* 149.

† When the beam is loaded uniformly throughout its length, the same rule will still apply, only the result must be doubled.

Problem II.

To compute the ultimate transverse strength of any Rectangular Beam, when supported at both ends and loaded in the centre.

Rule. Multiply the number in the table of multiplicands, by the square of the depth in inches, and four times the breadth; divide that product by the length in inches, and the quotient will be the weight.

Example 1.

What weight will break a beam of English oak 7 inches broad, 9 inches deep, and 30 feet between the props?

$$\frac{1426 \times 81 \times 28}{360} = 8983\tfrac{288}{360} \text{ lbs.}$$

Example 2.

A beam of beech, 7 inches deep, 4 inches broad, and 10 feet long, supports a weight of 4 tons, what additional weight will require to be added to break the beam?

$$\frac{1556 \times 49 \times 16}{120} = 10332 - 8960 = 1372 \text{ lbs.}$$

When the beam is uniformly loaded throughout its length, the result must be doubled, *i. e.* it will support double the weight.

When the beam is fixed at both ends and loaded in the middle, one-half of the result must be added; and if the weight is laid uniformly along its length, the result must be tripled.

These problems are taken from Barlow's Essay, as before quoted: he, however, gives a second rule to each of the problems, in which the angle of deflection is considered. These rules give higher results than those here stated; but for practice, the first rule is the best, being more simple and safe.

It is considered that two-thirds of the result is sufficient to lay upon a beam for a permanent load.

*Practical Problems for the Transverse strength of Cast-Iron Beams.**

Problem I.

To find the breadth of a uniform Cast-Iron Beam to bear a given weight in the middle.

Rule 1. Multiply the length of bearing in feet, or the length between the supports, by the weight to be supported in lbs.; and divide this product by 850 times the square of the depth in inches; the quotient will be the breadth in inches required.

Rule 2. Multiply the length of bearing in feet, by the weight to be supported in lbs., and divide this product by 850 times the breadth in inches; and the square root of the quotient will be the depth in inches.

* See Tredgold's Practical Essay on the Strength of Cast-iron, p. 80.

When no particular breadth or depth is determined by the nature of the situation for which the beam is intended, it will be found sometimes convenient to assign some proportion; as, for example, let the breadth be the n^{th} part of the depth, n representing any number at will. Then the rule is as follows:—

Multiply n times the length in feet, by the weight in lbs.; divide this product by 850, and the cube root of the quotient will be the depth required; and the breadth will be the n^{th} part of the depth.

Note. It may be remarked here, that the rules are the same for inclined as for horizontal beams, when the horizontal distance between the supports is taken for the length of bearing.

Example 1.

What is the breadth of a beam 20 feet long, 15 inches deep, and to be loaded with 13 tons?

$$13 \text{ tons} = 29120 \text{ lbs.}$$

$$\frac{29120 \times 20}{15^2 \times 850} = 3.045 \text{ inches broad.}$$

Example 2.

What is the depth of a beam 20 feet long, 3 inches broad, and to support a weight of 13 tons?

$\frac{29120 \times 20}{850 \times 3} = 225$, the square root of which is $= 15$ inches, the depth required.

Example 3.

What are the cross sectional dimensions of a beam 30 feet long, and of sufficient strength to support a weight of 10 tons; the depth being twice the breadth?——n will therefore be $= 2$

10 tons$=$22400 lbs. Length $= 30$ $30 \times \overset{n}{2} = 60$

$\frac{22400 \times 60}{850} = 1581$, the cube root of which is nearly $11\frac{1}{2}$, which is equal to the depth in inches: the breadth is the half of the depth $= 5\frac{3}{4}$ inches.

PROBLEM II.

To find the breadth, when the load is not in the middle between the supports.

Rule. Multiply the short length by the long length, and four times this product divided by the whole length between the supports, will give the effective leverage of the load in feet; this quotient being used instead of the length, in any of the rules in the foregoing problem, the breadth and depth will be found by them.

Example.

What are the cross sectional dimensions of a beam 12 feet long,

supporting a weight of 15 tons, 3 feet from the one end, when the breadth is a fourth of the depth?

$\frac{3 \times 9 \times 4}{12} = 9 \quad 9 \times 4 = 36 \quad$ 15 tons = 33600 lbs.

$\frac{33600 \times 36}{850} = 1423$, the cube root of which is $= 11\frac{1}{4}$, the depth: the breadth will be $\frac{11\frac{1}{4}}{4} = 2\frac{13}{16}$

Problem III.

To find the breadth when the load is uniformly distributed over the length of the beam.

Rule. The same rules apply as in prob. 1, only the divisor is changed from 850 to 1700, *i. e.* when the load is uniformly distributed over the length of the beam, it supports double the weight than when the load is laid on the middle.

Note. Examples in problem 1, apply to this problem, only changing the divisors, or halving the quotients.

Problem IV.

To find the dimensions, when a beam is fixed at one end and loaded at the other, or when it is supported at the middle and loaded at both ends.

Rule. Take the horizontal length of the projection of the beam, when fixed at one end, for the length, and apply the rules in prob. 1, only using the divisor 212 instead of 850.

When the beam is supported any where between the two ends, multiply the length from the prop by the weight hung at the end, and apply the remainder of the rule as in prob. 1, only using 212 for 850.

When the load is uniformly distributed over the length of the projection, employ 425 instead of 212 as a divisor.

Note. The rules of this problem apply to the teeth of wheels, the length being the length of the teeth, and the depth, the thickness of the teeth.

Example to this Note.

Let the greatest power acting at the pitch line of the wheel be 6000 lbs., and the thickness of the teeth $1\frac{1}{2}$ inch, the length of the teeth being $\frac{1}{4}$ foot; what is the breadth of the teeth?

$\frac{6000 \times .25}{212 \times 1.5^2} = \frac{1500}{477} = 3.14$ inches the breadth; but to allow for wearing by friction, this quotient is doubled, or $6\frac{1}{4}$ inches = the breadth of the teeth, or face of the wheel.

PROBLEM V.

To find the diameter of a solid cylinder to support a given weight in the middle—between the middle and the end—and when the weight is uniformly distributed over the length—also when fixed at one end.

When the weight is placed in the middle.

Rule. Multiply the weight in lbs. by the length in feet; divide this product by 500, and the cube root of the quotient will be the diameter in inches.

When the weight is between the middle and the end.

Rule. Multiply the short end by the long end; then multiply that product by 4 times the weight in lbs. Divide this product by 500 times the length in feet, and the cube root of the quotient will be the diameter in inches.

When the load is uniformly distributed over the length.

Rule. Multiply the length in feet by the weight in lbs., and one-tenth of the cube root of the product will be the diameter in inches.

When fixed at one end, and the load applied at the other.

Rule. Multiply the length of projection in feet by the weight in lbs., and the 5th part of the cube root of this product will be the diameter in inches.

The rules for the deflection of beams and bars are here omitted, it being considered, that, in most practical cases, the deflection is of little importance; however, when it is of importance, reference to Barlow's Essay on the strength of timber, and Tredgold's Essay on the strength of iron, will satisfy all inquiries. These books ought to be in the possession of every mechanic, as they give the most comprehensive and most correct data, for the strength of materials, of any that have yet appeared.

[TO BE CONTINUED.]

Remarks upon Bleaching.

THE improvements made in the art of bleaching during the last half century, have, in some measure, conquered the prejudices inseparable from long established habits; and practical men, though strongly wedded to their own methods of working and sufficiently jealous of projected improvements, have yielded reluctantly to a conviction of their utility. It is presumed, that the usual method of chemical bleaching as now practised, both in Europe and the United States of America, is too well known to require a particular description. In that method, there appears to me to be a fundamental error in the alternate use of hot and cold liquors. It is evident, that a heated solution of alkali opens and expands the fibres

of linen submitted to its action, and thus affords an opportunity for the alkali to act upon its colouring matter, and to increase its solubility. But the second step in the ordinary process of bleaching, counteracts the first. The linen is taken *hot* from the bucking tub, and immediately thrown into *cold water*, for the purpose of being washed. The fibres of linen collapse; the colouring matter is condensed, and its affinity for the linen is restored, which is manifestly the reverse of the object intended to be gained by the process.—If the rinsing water be of the same temperature as the alkaline liquor, this reaction is prevented.

2dly. From this washing in cold water, the linen, after having been bucked a sufficient number of times, and exposed for months to the air in the fields, comes, in due course of time, to its second stage of operation.

The linen in large quantities, is immersed in vats of cold chloride of lime, in a quiescent state, and the bleaching properties of the liquor act upon it imperfectly and unequally, in consequence of the dense mass of linen, and the frigidity of the medium through which it has to act.

If the linen were put into the bleaching liquor moderately warmed, confined so as to prevent the escape of gaseous vapours, and then set into regular and constant motion, these objections would be obviated; the effect of the warm liquor would be uniform and active, which can never be the fact while it is cold, and in a state of rest.

What I have remarked concerning the manner of using alkaline and chloruretted liquors, applies with equal truth to the use of acidulated water in the third stage of bleaching.

3dly. The third most important point to be considered in the process of bleaching, is, the degree of heat to which the linen is subjected.

Bleachers are generally sensible of the advantages of heat, and various contrivances have been adopted to apply *steam heat* to the purposes of bleaching. But I am not aware that any one has attempted to bring his goods into *action* in steam heat *under pressure.* Nor do I know that there has ever been any mechanical invention brought into practice, by which it could be done, until my machine was constructed. The French bleachers have taken much pains to use an alkaline solution at a temperature above boiling heat, but without success. They seem to have a correct idea of the probable effect of increments of heat above that degree, but failed in their attempts to reach it, through the imperfection of their mechanical inventions.* But I can find no evidence of their ever having conceived an idea of the advantages likely to result from the combined action of *heat* and motion.

Unless the steam is brought to act *under pressure*, it is evident that no material benefit is gained by steaming instead of boiling—often the reverse, because the heat will never exceed, and the moment it is exposed to the atmospheric air, will fall below 212° Fah-

* Vide Berthollet on Dying.

renheit, or boiling heat. But if the steam is *confined*, it is easy to raise its heat to 230°, and then the effect upon the linen, shows, in the most unequivocal manner, the advantages of augmented heat in bleaching. This effect is not only more strikingly obvious, but is singularly beautiful, when the goods are put in motion, and the degree of bleaching is rendered perfectly uniform.

There can be no danger, as some have apprehended, of injuring the linen by excessive steam heat, because the scorching heat of steam is 520° Fah.—a pressure of fifty atmospheres, or seven hundred and thirty-five pounds upon a square inch—a pressure which no ordinary steam apparatus will resist.

Steam heat at 350° thermometical measurement, will so far soften soldering, as to cause it to yield to the pressure, and the steam pipes will burst. These are facts which I state as the result of my own repeated experiments, in which I cannot be materially mistaken, and, therefore, I feel justified in saying, that it is not possible, with any ordinary working apparatus, to carry steam to so high a temperature as to injure any goods submitted to its action. By giving motion to the linen, under the reciprocal action of steam heat, under pressure, and alkaline liquor, the effect is not only more powerful than it can be by bucking, but, as already hinted, it is more uniform. Every part of the cloth is equally exposed to the operation, and the colouring matter detached from the cloth, floats in the liquor below.

This appears to me to determine the question which some have raised, whether the colouring matter of linen is actually detached from the cloth, or is bleached upon it without being detached? When we find that the loss of weight, in the various methods of bleaching, ranges from twenty to thirty per cent.—and when we find the colouring matter suspended in the liquor, and reducible by evaporation to a mucus, it seems to me that there can be no doubt that the colouring matter is removed—at any rate, a large proportion of it. The repeated experiments which I have made upon a considerable scale in bleaching, clearly demonstrate the utility of combining heat and motion. The action is direct, immediate, and uniform. The strong affinity which unites the colouring, the glutinous and the oleaginous matter to the fibres of the linen, is weakened and rapidly overcome, and no opportunity is afforded for their subsequent combination.

By this method I have bleached Scotch drills in twelve hours, and Manchester cotton shirtings in four. There will be no occasion to croft cotton goods, but linens receive a clearer and more brilliant white, by exposure upon the grass for a few days.

JUNIUS SMITH.

Liverpool, Jan. 15th, 1828.

P. S. I have omitted to notice, that the saving in alkali by this method of bleaching, compared with the usual consumption by the English, Scotch, and Irish bleachers, is about twenty-five per cent.

[*Silliman's Journ.*

On the Action of the Moon on the Atmosphere.

The Bib. Univ. for Dec. 1827, contains a valuable memoir on this subject, by M. Flaugergues, astronomer at Viviers, in France. The author observes, that many geometricians have been engaged in researches on the action of the moon upon the barometer, but that their labours have not been attended with very satisfactory results. Nor have the labours of meteorologists been much more successful. The observations of some of these are contradictory and irreconcilable with each other. Several have inferred that the barometer is higher during the time the moon is in perigee than when she is in apogee; and others, that the mean height is greater in the syzygies than in the quadratures; but other observers have drawn opposite conclusions. The results of different years do not correspond. The fault may, in many cases, have lain in the instruments, which, for want of proper care and management, are liable to deteriorate. Considering, also, the many irregularities which attend the moon's motion, it is only by a long series of observations, that correct and satisfactory deductions can be formed. The author describes, at length, the instruments he employed, and the precautions which he observed to ensure accuracy in his observations. He extended his researches throughout a whole *Saros* or lunar cycle, and sums up the result as follows:—

Table of the mean heights at noon, of the barometer, at the observatory of Viviers, in the phases of the Moon, in the Apogee and Perigee of that luminary, and in the lunistices; deduced from the meridian observations of nineteen years, (19*th Oct.* 1808—18*th Oct.* 1827.)

LUNAR POINTS.	Number of observations.	Mean heights of the barometer.	Reduction to millimetres.
		pou. lig.	m. m.
Mean general height, - - -	6915	27 11.29	755.44
Conjunction, or new Moon, - -	234	27 11.27	755.39
First Octant, - - - - - -	234	27 11.26	755.37
First quadrature, - - - - -	234	27 11.26	755.37
Second Octant, - - - - -	235	27 10.94	754.65
Opposition, or full Moon, - - -	234	27 11.20	755.23
Third Octant, - - - - -	234	27 11.47	755.70
Second quadrature, - - - - -	234	27 11.68	756.32
Fourth Octant, - - - - -	235	27 11.31	755.48
Northern Lunistice, - - -	258	27 11.42	755.73
Southern Lunistice, - - -	258	27 11.28	755.42
Moon in Perigee, (Parall. equa. 60′ 24″)	252	27 10.97	754.72
Moon in Apogee, (Parall. equa. 54′ 4″)	252	27 11.46	755.82

It evidently appears from this table,

1st. That in a synodical revolution of the moon, the barometer rises regularly from the second octant, when it is the lowest, to the second quadrature, when it is the highest; and then descends to the second octant to commence again its rise, &c.

2d. The varying declination of the moon, also modifies her influence upon atmospheric pressure. It is greatest (at least in the latitude of Viviers,) when the moon's declination is south; whence it evidently results that the barometer is higher in the northern lunistice than in the southern. This observation is contrary to what M. de Laplace had concluded from his theory, viz. "that the sign (signe) of the declination of the two luminaries (sun and moon) has no sensible influence on the modifications of the atmosphere."*

3d. Lastly, the action of the moon, in diminishing the pressure of the atmosphere, varies with its distance from the earth. The mean height of the barometer, is less when the moon is in perigee, than in apogee; whence we may infer, that her action in diminishing pressure, is greater in the former than in the latter situation.

There exists between the phases of the moon and the days of rain which coincide with these phases, a constant relation, which would appear very singular, if what we have observed with respect to the barometer, did not furnish an immediate explanation. Agreeably to the extract which I have made from my meteorological journal of the rainy days which coincide with the days of the moon's phases, and with those of the perigee and apogee during the period of nineteen years, I have found the number of those days as follows.

	PHASES OF THE MOON.					
	New Moon.	First quarter.	Full Moon.	Last quarter.	Perigee.	Apogee.
No. of rainy days coincident with the days of the Moon's phases.	77 days.	82 days.	79 days.	60 days.	93 days.	78 days.

We perceive by this table, that the number of rainy days which coincide with the days of the phases, &c. follows the same march with the mean heights of the barometer corresponding with these phases, but in an *inverse order:* thus the number of days of new moon on which it has rained, is less than the rainy days of the full moon, and the mean height of the barometer on the days of conjunction, is greater than that of the days of opposition; in like manner, the rainy days of the first quarter, greatly exceed those of the last quarter, and the barometer heights are also inversely correspondent; lastly, the wet days of the perigee are much greater than those of the apogee, and the barometer follows a correspondent change.

We may, therefore, conclude that the diminution of the pressure

* Mécanique celeste, t. ii. p. 298.

of the atmosphere caused by the attraction of the moon, ought to be reckoned among the causes which determine the fall of rain.

[*Ib.*

Notice of an instrument denominated the Sideroscope, by which the presence of very minute quantities of iron may be detected.

An instrument has been invented in France, to which the above name has been given, provisionally, from the extreme facility and delicacy with which it indicates the smallest portion of iron in any substance, mineral, vegetable, or animal.

It consists briefly, of a small straw, nine inches long, through one end of which pass at right angles, two fine sewing needles, sixteen lines in length, both strongly magnetized, weighing only one grain. They are inserted in contrary directions. Through the other end passes a single sewing needle, of the same length, weighing a grain and a half, magnetized in the same manner. This instrument is suspended inside of a glass case, by a single untwisted fibre of raw silk, twelve inches long; substances to be examined, are introduced into the case, by a lateral opening. The whole instrument weighs but four grains, and the utmost care is observed to exclude from the frame or table of wood which supports it, the smallest particle of iron, and to avoid the disturbing effects of a current of air, and even of the breath.—The substances to be presented for trial, are pasted to a small strip of card or pasteboard, to avoid the heat of the hand or fingers.

Almost every piece of money, French or foreign, ancient or modern, gold, silver, or copper, but especially the silver coins of Italy, attracts the sideroscope with greater or less activity: it is the same with all substances, mineral, vegetable, or animal, which contain the least atom of iron, nickel or cobalt. Platina exercises a decided action, notwithstanding all the chemical operations necessary to bring it to a soft state.

Small masses of any of the following substances, weighing at most, eight or ten grains, affect this delicate instrument. All kinds of ashes, compacted by a little gum water; blood simply dried or swelled; chocolate; bottle glass; tourmalines, green and black, not rubbed or warmed; granite; rhomboidal quartz; yellow topaz; green talc; sulphate of iron; all volcanic products; all metals not chemically pure; brass pins, even the finest used by entomologists; various galenas and other minerals; all ærolites; burnt hoofs and horns of cattle, &c.

The most surprising effect of the sideroscope is, the *repulsion* of the needle by bismuth and antimony.

[*Ferrussac's Bull. Juillet*, 1827.

Notice of a Varnish composed of Copal and Spirits of Wine alone, prepared at Barcelona, in Spain.

TO THE EDITOR.

Sir,—I send you the following, hoping it may be of service to the public. I cannot aver that there is any thing new in it; that I leave to your better judgment.

Yours, &c.

Baltimore, Dec. 11, 1828. R. A. D.

Translated for the Journal of the Franklin Institute.

From the Diario Mercantil, of Cadiz, October 30, 1828.

Spanish Varnish.

The formation of a varnish composed of gum copal and alcohol, without the addition of any other substance, has long been the subject of the investigations of the most noted chemists of Europe. As yet, *their* efforts have not been successful.

Felix Urguelles, an inhabitant of Barcelona, after numerous trials, succeeded in drawing from the mysteries of nature a secret hitherto unknown—the formation of a varnish superior to any other hitherto made. His repeated trials of this varnish convince him of its superiority. Its principal qualities are, its extreme whiteness; it is so hard, that it resists the action of the sun without cracking; so elastic, that any thing on which it is spread may be doubled, without injury to the varnish. He has applied it with success upon iron and tin, and cups and boxes of steel, hats made of pasteboard, &c. Experiments were made with it before a committee of the Royal Chamber of Commerce of Barcelona, who expressed themselves highly pleased with their results.

Remarks by the Editor.—It is much to be doubted whether there is any thing new in the varnish above referred to. If it is composed of the two ingredients named, its toughness must be that which is due to the resin alone, and a varnish of this description has been repeatedly made. Copal has been dissolved both in alcohol and spirits of turpentine, by suspending it in the neck of a matrass, and allowing the vapour from the boiling liquid to come in contact with it. The solution has also been frequently effected, by rubbing up the resin in a mortar, with some of the essential oils, or with camphor; and William Hembel, esq., of Philadelphia, dissolved copal with the most perfect facility, in alcohol which he had rectified with peculiar care. This subject shall be resumed hereafter.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS GRANTED IN OCTOBER, 1828.

With Remarks and Exemplifications by the Editor.

26. An improved *Furnace for Melting Cast-iron*, and converting cast into malleable iron, and an improvement in the manufacture of malleable iron; Benjamin B. Howell, Philadelphia, October 11.

The specification, with engravings, will hereafter be published.

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27. An improvement in *Rail-way, and other Carriages,* denominated "Winans' Friction-saving Rail-way Carriage;" Ross Winans, Vernon, Sussex county, New Jersey, October 11.

In the various drawings which accompany the specification of Mr. Winans' invention, several different methods of applying friction rollers, or secondary wheels, as he denominates them, are exhibited. For a common carriage, or gig, a friction wheel is placed on the upper side of the shaft, or in a mortise within it, its axis turning in brasses, properly secured, one of them being fixed over each end of the main axle, just within the nave of the wheel. The axles are retained in their places, under the centres of the friction wheels, by staples, in which they turn freely, and which staples are, sometimes, to be lined with brass. Sometimes two lateral friction wheels are substituted for the staples, so that the main axle is supported by three friction wheels, or rollers. Sometimes two friction rollers are so placed, that their peripheries intersect each other, and in this intersection the axle runs; most of our mechanical readers are familiar with the use of such rollers, in supporting the axes of fly, and other wheels, used in machinery.

For rail-way carriages, the friction wheels are made with a rim, projecting inwards, like the rim on the side of a crown wheel. The ends of the axles of the main wheels, pass within, and rest against these rims. In this case, it is evident that the centre of the friction wheel, will be below the carriage axle. There are brass boxes, or staples, which embrace the main axles, to check that too free lateral motion which would take place, were they confined only by their bearing within the rims of the friction wheels.

In the single-rail-way, as proposed by Mr. Palmer, in England, the load is to be divided into two portions, and suspended in carriages below the wheels; Mr. Winans has given a drawing of the mode in which he proposes to adapt to such carriages, his last described secondary wheels, with a projecting rim.

After discussing at some length the merits of the modes of construction proposed in the specification, the patentee concludes as follows:—

"And I declare the principle of my improvement, machine, or carriage, as aforesaid, and described, to consist in the employment of secondary wheels, bearing the loading on their axles, the peripheries of which secondary wheels, are turned by the revolution of the axle of the primary, or travelling wheels, the main axle thereof, by its gudgeons, or journals, rolling on, or in, the said peripheries when the carriage is moved, thus changing the usual rubbing motion of the main axle to a rolling one, and thus, conveniently, and greatly, increasing the relative leverage between the diameter of the travelling wheels and the axles immediately bearing the load, and thus increasing, greatly, the comparative slowness of the rubbing motion at the bearing axle, compared with the motion of the periphery of the travelling wheels, or progressive motion of the carriage."

28. A microscopic *Pen Machine;* John Bennet, Lowell, Massachusetts, October 11.

The pen is to be cut in the common way, with the exception of cutting the nib, in doing which the machine is destined to lend its aid. A double convex lens is fixed in a brass slide, and under it there is a cylindrical piece upon which to pass the pen, the nib of which is to be cut: this cylindrical piece may be raised or lowered, so as to adapt it to the focus of the lens, when the nib is to be cut with the penknife, as usual.

We are very apprehensive that, like ourselves, the greater number of those persons for whose use the Microscopic Pen Machine is designed, will prefer two double convex lenses fixed in a silver frame, and placed across the nose, as such an apparatus is found to be very convenient in preparing the quill for, as well as in giving it, the final cut.

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29. An improved method of making *Weeding and other Hoes;* James A. Black, Columbia, South Carolina, October 13.

(See the specification in this number.)

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30. Improvement in the machine for *Casting Printing Types*, originally invented by Mr. Wm. Johnson; George F. Peterson, New York, October 13.

(See the specification.)

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31. Improvement in the construction of a *Furnace for Generating Steam by Anthracite Coal,* and for the use of various manufactures requiring intense heat; Benjamin B. Howell, Philadelphia, October 14.

This, as well as No. 26, will hereafter be published, with engravings.

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32. A top press roller, to be attached to the *Machine for making Paper;* Mason Hunting, Watertown, Massachusetts, October 20.

(See specification.)

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33. An improvement in the *Plough;* Stephen M'Cormick, Fauquier county, Virginia, October 22.

The original patent for this improvement, was issued January 28, 1826; but in consequence of defects in the specification, this has been surrendered, cancelled, and the seal broken, and the present patent issued, bearing date with the former.

The specification of the above invention is of considerable length, and the subject not to be understood without the drawings, which, at present, it is not our intention to furnish. There are models in the patent office of about 120 varieties of the plough, varieties, we say,

although in many instances it would be difficult to tell in what the difference between them consists. Mr. M'Cormick's is said to be a good plough, and the improvements which he claims, are,

"*First.* The share, &c.; the bar made thick at the bottom, and thin on the top edge; putting a piece from the point of the share of the plough, up to the point of the mould board; and the application of the improvement in the shoe, to raise and lower behind, at pleasure.

"*Second.* The method in which the mould board is wrought; the shape of its face, or mould part; the curve, or projection over towards the land side; the long hole through its top, for the beam bolt; the catch at the bottom to fasten it to the share; and the concave groove for the handle.

"*Third.* The situation of the fore part of the mould board for the cast share, and the self-sharpening point; the position of the brace bar, between the land side and mould board, for the point to rest on, and to fasten it to; the length of the point, and the manner in which it is fastened to the brace bar; the shape of the share, for the point to rest upon.

"*Fourth.* The shape of the sword with two edges; the manner in which it is fastened to the side of the beam with a staple.

"*Fifth.* The stock; the method of fastening the handle and beam together, with a staple; fitting the handle in the concave groove; and adjusting the beam on the top of the mould board: all of which is fully specified in the foregoing."

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34. Improved mode of *Tanning Belt, or Picker Leather;* John J. Travis, Franklin county, Connecticut, Oct. 22.

The improvement consists in the ingredients used in the tanning; and this it is contrary to our plan to publish.

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35. *Felloes of Cast-iron,* for wheels, trucks, carts, wagons, coaches, &c.; George Andrews, Tolland, Connecticut, Oct. 24. (See specification.)

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36. *A Percussion Cannon Lock;* Joshua Shaw, Philadelphia, October 24.

This will hereafter be published.

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37. Improved mode of *applying Water to Flutter-wheels;* James Stewart, Robertson county, Tennessee, October 24.

The patentee claims to have "discovered that water possesseth two powers, gravity and velocity," and his improvement consists in uniting them.

We are at some loss in discovering any novelty either in the powers that water possesseth, or in the mode of applying them, and, therefore, dismiss them without further remark.

38. Improvement in the *Hubs and Axletrees* for wheels; Phineas Slayton, Lockport, Niagara county, New York, October 27.

That which is claimed as an improvement in the specification before us, is the invention of rollers within the hub, or nave, of a wheel or pulley, surrounding the axle or gudgeon, so as to lessen friction. It is proposed, sometimes to insert rollers in the under side of the axle, to bear upon the boxes, for the same purpose. Mechanicians know that a patent was obtained by a Mr. Garnett, in England, some forty years ago, for friction rollers, applicable to various kinds of machinery. They were very ingeniously contrived for converting the whole of the rubbing into a rolling motion. In theory, they were excellent, but in practice they were far from fulfilling the promise which they had made. They were found to be altogether inapplicable to carriages, and, indeed, in every case where a rapid motion was required; as the least want of truth in the workmanship, or from wear, caused them to *gather*, and, consequently, to increase the friction which they were designed to prevent. In many instances, the cylindrical roller became a polygon; and, we believe that, excepting where the bearing is short, and wheels, rather than rollers, can be applied, there is no instance of their continued employment.

Many of Garnett's friction rollers have been applied both in England and the United States, to ships' blocks, and other kinds of pulley, and when well made, and properly used, have, of course, greatly lessened the friction.

We leave the claim of utility or novelty in the *invention* of the present patentee, to the test of experience, and to the tribunal to which it most properly belongs.

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39. Improvement in the mode of forming or making *Hat Bodies;* Henry F. West, and Andrew H. Stevens, Richland, Oswego county, New York, October 29.

(See the specification.)

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40. A method of *Propelling Boats;* Stephen Ross, Troy, New York, October 30.

This method of propelling, is intended to be used principally, or exclusively, for ferry boats. A horizontal wheel, with a vertical shaft, is to be propelled by the feet of a horse, in the manner commonly known. A cog wheel, on the vertical shaft, placed below the platform on which the horse treads, turns a horizontal shaft, standing across the boat, and projecting beyond its side. Upon one end of this shaft, and outside of the boat, there is a cog wheel, which takes into two other cog wheels, whose journals are attached to the side of the boat, so that the centres of the three wheels are in the same horizontal line. These wheels have drums, or projections, attached to them, around which a chain, or rope, may pass. A chain, or rope, is to be stretched across the river, and securely

fastened at each end. When the boat is to cross, the chain, or rope, is made to pass over the drums of the two outer, and under that of the centre wheel, on the side of the boat. At each end of the boat there are pulleys, to support and direct the chain. When not supported by the wheels, the chain is of such length, as to lie upon the bed of the river.

Certain provisions are suggested in particular cases, which it is not necessary to notice.

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41. Improvement in the patent granted to Matthew Chandler and Ezra Brown, for *Wire Harness for Weaving;* Ezra Brown, Cazenovia, Madison county, New York, October 30.

(See specification.)

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42. Making paper of the *Husks of Indian Corn;* Andrew and Nicholas A. Sprague, Fredonia, Chatauque county, New York, October 31.

A patent for the same purpose, was granted to Burgess Allison and John Hawkins, December 30, 1802.

We have not examined that patent, and, therefore, do not know what difference there may be in the two processes. The specification of the present patentee, is in the following words.

"To one hundred and twenty-eight gallons of water, put in ten quarts of good lime, or about six pounds of good alkalies, and place therein about one hundred and ten pounds of clean corn husks, or flag leaves; let the water be moderately heated, over a moderate fire, for two hours, when they will be ready for the engine, there to be worked, and managed in every respect as rags are, for the making of paper."

Specifications of American Patents.

Specification of an improvement in the mode of making or forming Hat Bodies. Patented by Henry F. West, *and* Andrew H. Stevens, *Richland county, New York, October* 29, 1828.

First. A complete carding machine, with the exception of the roller and doffer, the doffer being covered with filleting cards, which brings the wool from the machine in a continued web.

Secondly. This web alights upon a table, constructed for its reception, about five feet in length, and three in width, with rollers in each end, over which an apron passes, the rollers moving by a band, or by cog wheels, attached to the machine above described, with sufficient velocity to receive the web free from wrinkles, and without stretching it in the least, carrying it from the place where it first strikes, or alights, upon the apron, to the other end, perfectly smooth.

Thirdly. From this the web is taken, by a hat former, (this being the only part of the machinery herein described, which the petitioners claim as their invention, together with the manner of using the hat former, and the right of forming hats on the apron and table,) the hat former consisting of a board from three feet to four feet and four inches in length, and from 16 inches to thirty-two inches in width at the centre, according to the size of the hat to be formed; being tapered from the centre to each end, leaving the ends from 5 to 12 inches, which are made round, the board forming, from its dimensions or shape, two hat bodies, one at each end.

Fourthly. The web is wound upon this board, by laying the board, or former, upon the table, and rolling it onward, the apron advancing in the meantime: (the board may be previously covered with some kind of thin cloth, from the centre to the ends, which causes the web to cleave to the hat former, the cloth consisting of two pieces, one at each end;) the web diagonally covering the former on all parts, smoothly, as the workman wishes, who turns the former, standing at the other end of the table.

Fifthly. After the hat bodies are thus wound upon this board, or former, they are cut, or torn, in the centre, and taken from each end; the cloth may come from the former at the same time, and with the hat bodies, then be taken from them, and placed again around the hat former.

HENRY F. WEST.
ANDREW H. STEVENS.

Specification of an improved Top Press Roller, to be attached to the machine for Making Paper. Patented by MASON HUNTING, *Watertown, Middlesex county, Massachusetts, October* 20, 1828.

1. THE roller, or cylinder, may be made in the usual way and form, and of the usual materials, but of such a size or diameter as will give a sheet of paper of the required dimensions, by one revolution on its axis.

2. A slit or groove must then be cut in the roller, in a straight line from one end to the other. This slit, or groove, may be from one-quarter to half an inch wide, and from one to two or more inches deep. The roller thus constructed, will continue to receive the paper from the felt, when the machine is in motion, till it has revolved a sufficient number of times to give to the paper, or sheet, any desirable thickness, when the person attending will, without stopping the machine, take the sheet from the roller, by applying his fingers to the sheet at the ends of the roller, at the groove, when it will separate along the groove; he will then take it off and place it upon the lay-stool, and in this manner continue the operation.

3. A small bell may be attached to the roller, which shall give notice to the person attending, when the same shall have performed the number of revolutions necessary to give the sheet the requisite thickness.

4. A knife acting on springs, may be placed within the groove to cut or separate the sheet at any given number of revolutions of the roller: or the sheet may be divided by passing a small circular saw, turning on an axis along the groove, by the person attending. It is, however, believed, that taking off the sheets from the roller, by hand, will be the best way.

By means of this improved roller, paper of any thickness may be made by a single and simple operation—where it has been heretofore necessary that a number of thicknesses, or sheets, as they come from the mould, should be pressed together to form one solid sheet or mass; such as paste-boards, playing cards, press papers, book binders' boards, sheathing paper, &c. &c. MASON HUNTING.

Specification of an improvement in Felloes of Wheels, for Trucks, Carts, Wagons, Coaches, Chaises, and all kinds of Wheels ordinarily made use of for transporting loads, for pleasure or business. Patented by GEORGE ANDREWS, *Tolland, Connecticut, October* 24, 1828.

THE rims, or felloes, are to be made of cast-iron, and may be cast whole, or in pieces or segments.

The rims, or felloes, if cast whole, may be used with or without a band or tire, and must be cast with a mortise, open in one side, to receive the ends of the spokes, with a groove to receive a slide to fasten the spokes into the felloes. The slides are to be made of wrought iron, and fastened to the spokes by a bolt, or screw.

The felloes, or rim, to be made with swells where the spokes enter them. The segments are put together and united by a tenon and mortise at the ends, with a small space at the end of the tenon sufficient to receive a bolt to hold the band, or tire. The felloes should be cast with swells in them, where the ends of the segments meet, and a similar swell where the spokes go into the felloes; those swells are designed to give more strength to the wheel. The shape of the felloes may be varied to any that may be wished.

The peculiar excellence of this kind of felloe, is, that it is more durable than wood, not being subject to rot, or decay, by being used, or exposed to the weather; and will remain good as new ones, when the spokes and other parts of the carriage which are made of wood, shall be wholly demolished by age and use, and can be easily obtained when suitable timber for felloes cannot, and can be afforded equally as cheap as those made of wood. GEORGE ANDREWS.

Specification of a mode of making Weeding and other Hoes. Patented by JAMES A. BLACK, *Columbia, South Carolina, Oct.* 13, 1828.

AN anvil with a face ten or twelve inches, by twelve or fourteen inches on the face, on which the size of the blade of the hoe is sunk,

nearly as deep as the hoe blade is thick, with also the thickness of the eye of the hoe spread out flat, sunk in the same. From the centre of the blade to the middle of the eye as thus spread out, the anvil is still deeper sunk, so as to receive the ridge extending from the centre of the blade to the eye of the hoe when made. On this anvil a tilt or trip hammer works, with a face large enough to cover both blade and eye as extended or spread out. This hammer is put into motion in the usual way as now practised in forging iron. The hoe is made from a bar of iron about seven-sixteenths thick, and four, or four and a half, inches wide. The bar is heated and laid on the anvil, the end extending to the edge of the blade, or nearly so, and passing back over the centre of the eye. The action of the hammer forges the iron down into the sunk part of the anvil, until the iron begins to spread over the high part of the face of the anvil, and is made of the proper thickness for a hoe. In this part of the operation, the back part of the blade and the inside of the eye are up next the hammer; the upper side of the blade and outside of the eye next the anvil. The hoe is then trimmed by a pair of shears, such as are used by tin-plate workers, down to the impression made by the sink in the anvil. These shears are worked by a crank on the same shaft that gives motion to the tilt hammer. The hoe is then heated, and the blade part fastened in a vice made for the purpose; one jaw of the vice is flat; the other is formed so as to receive the ridge on the face of the hoe, and the upper part sunk or indented so as to fit the round of the eye. While the iron is at a proper heat, it is turned down to the front, and swedged in to the last described jaw of the vice, so that the eye is brought to form a square with the blade. Then the two wings which form the eye, are turned over so as to lap one over the other on the back, or pole, of the eye, at which place they are welded at a subsequent heat and operation. What is claimed as new and an improvement in the art of manufacturing weeding and other hoes, by this method, is, forging the blades and eye at the same operation, with a tilt hammer, at which time, one side of the hoe and eye is perfectly flat, the other only varied by the different thicknesses required. From this shape, the hoe is completed by squaring the eye to the front, and turning the wings so as to meet and lap over. There are many operations I use which have been, heretofore, practised. JAMES A. BLACK.

Specification of an improvement on the patent granted to MATTHEW CHANDLER *and* EZRA BROWN, *for Wire Harness for Weaving. Issued to* EZRA BROWN, *Cazenovia, Madison county, New York, October* 30, 1828.

WHEREAS, in the original harness, each heddle is formed of two pieces of wire, usually between Nos. 24 and 27, each about ten inches in length, and formed into a staple, by being bent in the centre, the prongs brought parallel at about one-sixteenth of an inch

distant from each other, each end turned inward till it forms three-fourths of a circle, and is brought against the wire, and at right angles with it, forming an eye nearly round, and of a size that would easily admit a rod of the size of No. 12 wire, which rod supports the heddles by being attached to the shaft. In one of these loops, an eye is formed, about three-eighths of an inch in length, and one-sixteenth of an inch in breadth, by twisting the prongs together in a close manner, once and three-fourths round, which places the eye in the proper position to receive the thread by which it is occupied. This is called the eye part, and the other the loop part of the heddle. The loop is put through the eye, and each part extended to its respective rod and shaft.

In the improved harness, each heddle is formed of two pieces of wire bent in the same form as in the original, with the following exceptions and difference. Where the loops are bent in the centre, the prongs are brought parallel, and so close as barely to admit a wire of the same size. In one of these loops, two eyes are formed in succession, the first by twisting the prongs together closely once and a half round, leaving an eye about one-fourth of an inch in length, and in breadth barely sufficient to admit the loop by which it is occupied; the same prongs are again twisted together closely, once and three-fourths round, forming the second eye between this and the first twist, about three-eighths of an inch in length, and one-sixteenth of an inch in breadth, or of such other dimensions, as the nature of the weaving, and general convenience require. This last eye is occupied by the thread. When twisted as above, both eyes range in the same and in the proper direction. The eye part is made about an inch longer than the loop, by which means the eye that is occupied by the thread, is situated nearly at an equal distance from each shaft. In each part, the prongs are prevented from separating apart, by twisting them around each other in a slack manner between the eyes and either shaft.

The signal advantage of this improvement is, that the eye which is occupied by the thread, is not encumbered by the interlocking of the loop, whereas, in the original, the thread is evidently exposed, and frequently broken, by getting fastened between the wires where they lock together. EZRA BROWN.

Specification of an improvement on a machine for casting Printing Types, originally invented by Mr. WILLIAM JOHNSON, *called a "Type Machine." Patented by* GEORGE F. PETERSON, *New York, October* 13, 1828.

THIS improvement in Johnson's type machine, varies from all others, in the following particulars.

1st. In applying a spiral spring instead of a weight, for the purpose of forcing the plunger downwards.

2d. In having separate chambers in the bottom of the pot, one larger, for the plunger to work in, the other for the stopper-rod.

3d. In having the cap suspended under the pot, on a frame, for the purpose of letting the same rise, and fall, in a position parallel with the top of the mould.

4th. In applying a spiral spring fixed on the connecting rod of the stopper, for the purpose of raising the same; on the lower end of the stopper-rod is a stirrup, surrounding a wheel with an indentation; a pin is fixed in the bottom of the stirrup, falls into this indentation at every revolution of the axis, when the mould is brought up against the spout, thereby permitting the stopper to be raised while the metal is forced into the mould.

5th. In using a perpendicular movement, by which the mould is drawn from the spout, and kept in a horizontal position, which is obtained by means of a sliding frame, in which the mould-bed is hung. To the sliding frame is attached a perpendicular rod, on which plays a slide, to which is joined a shakle bar, passing obliquely, and connected to the end of the mould-bed, next the mould; the slide and perpendicular rod, are put in motion by the main lever. The sliding frame is raised when the mould-bed has attained a horizontal position, by the slide on the perpendicular rod striking a fixed collar, and is brought down again, by a lever connected with the collar, by an arm on the axis.

6th. The permanent frame in which the sliding frame moves, is fastened on a circular plate, through which, and the permanent frame, the perpendicular passes.

7th. The improvement in opening and closing the mould, consists in using a spiral spring, to give pliancy, so that the mould may accommodate itself to different thicknesses of matrixes, which is obtained in the following manner. Two cylinders are placed on the mould-bed, one within the other; through the inner one, passes a rod surrounded by a spiral spring. The rod is continued out at both ends of the cylinders. The outer cylinder is slit, exposing to view the inner one, which is connected to a lever by a rod having two regulating nuts. To the end of the rod next the mould, is fixed a plate which is attached to the back of the moving half of the mould, but borne off by an intervening spring, to give pliancy to the mould —through the fixed plate is a regulating screw, operating on one end of the intervening spring.

8th. The permanent side of the mould is fastened to a shank, which is hollow, to afford a passage for water.

G. F. Peterson.

Specification of a patent for an improved Rail-way Carriage. Patented by William Howard, Esq. *of the city of Baltimore, United States Civil Engineer, November* 22, 1828.

(with three copper plates.)

Be it known that I, the said William Howard, have made, invented, constructed, and experimentally applied to use, a new and useful improvement in the construction of carriages, intended to travel upon rail-ways, called by the name of "the Improved Rail-way Carriage," specified in the words following: that is to say, To render more useful the establishment of a rail-road through a broken country, it has been a desideratum to construct a carriage which shall move with as much facility upon a serpentine, or curved, as on a straight road, and, at the same time, not to lose the peculiar advantages which the common method of fixing the wheels on the axis, possesses. It is also desirable to lessen, if possible, the amount of friction, by means not too complex for general use. These two ends, it is proposed to attain in the construction of the wagon hereafter described, upon the principles now set forth. These principles are as follows.

1st. The connexion of the two beds of the axles at a point equidistant from each; and in the same manner the connexion between the hind bed of one wagon, and the fore bed of that following it, or the fore bed of the leading wagon with any system of guide wheels, so that the wheels, not only of one wagon, but of a train, will follow one another in the same curve, without more lateral friction than when on a straight line.

2d. The making the axle revolve in its journals, and at the same time rendering either one or both wheels capable of revolving independent of the axle, as in a common carriage.

3d. The application of a simple friction wheel, to diminish the friction of the axle on its journal.

To explain these principles in detail,

1st. If there be a track of a rail-road of a circular form, and we wish a carriage to move on it without lateral friction, the planes of the wheels must be parallel to the tangents of the two circles at the points where they rest on them, and each axle, consequently, in the direction of the radius of the circle. To find the point at which the axles must be connected to produce this effect, draw a perpendicular from the middle of each, and the intersection of these two perpendicular lines will be the point of junction required. The advantage of this over the common construction, is, that there the pivot of the beam connecting the axles, is on the foremost axle, and, consequently, in turning, the hind wheels do not follow the tracks of the foremost ones, but describe a curve of smaller radius, causing great lateral friction on the rails.

2d. The principle of making the wheels revolve with or without the axles in the present case, is, to secure the advantages of the axle

generally revolving with the wheels, and at the same time to permit one wheel to revolve faster than its fellow, when moving on a curved part of the road. The trifling relative movement which this would produce between the axle and the wheel, would admit of these being adapted with considerable exactness.

3d. In the application of the friction wheels, instead of an axle resting on the summit of a wheel, as is the usual method of application, and the only one known to the inventor, the wheel with its load is here made to rest upon the axle.

According to these principles, the combination of which, into a rail-way carriage, forms the ground of the patent claimed by the inventor, the carriage itself would be constructed as follows.

The size of the wheels, their distance apart, and the distance between the axles, are in the common proportions used in rail-way carriages. The connecting beam between the fore and hind axles, is fastened firmly thereto by jaws or frames, to prevent lateral motion. This beam is divided in the centre between the axles, one end having a tooth, and the other a socket, cut of the epicycloid form, to keep the point of action at an equal distance from the centres of each axle. The axles are kept together by fastening the body by bolts to the beds resting upon each. Another method of construction, is, to extend the beam from the hind axle, until the end of it rests upon the bed of the fore axle, while the beam from the fore axle reaches to a short distance only behind the central point of action. A bolt then passed through the centre of the hind frame and the end of the fore frame, and equi-distant from the axles, forms the pivot or point of action between them. In this case, the wagon is fastened firmly to the hind bed only, and to the extremity of the hind beam, which rests on the fore bed, which is made to traverse, laterally, more easily by a small roller upon a curved strip of iron.

The friction wheels are contained between upright stands, or supports, of cast or wrought iron; each wheel having one on each side connected at the top by a bolt and nuts, and having jaws at the bottom, wide enough to admit the axle in contact with the friction wheel; each pair of friction wheels is connected by iron bars passing through each arm of the jaws of the supports, and secured by nuts: between these bars the axle revolves, and the bars rising above the axle, receive the beam, and form the fore and hind beds to which the frames of the beam are securely nutted. To obviate the little friction which may arise from the centre of the friction wheel being directly above the centre of the axle, it may be placed a little obliquely, and a small friction roller used in one of the arms of the jaws, to destroy the additional friction there.

The axles have two shoulders at each end, one of which supports the wagon wheel, and is either firmly fixed to it, or only secured by a linch-pin; and the other revolves upon the friction wheel.

These principles are not new, but the combination of them into a rail-way carriage is new, and entitles, the inventor believes, that his invention be secured by patent. The peculiar application of friction wheels, is also new, and claimed as original.

WILLIAM HOWARD.

Description of the Plates.

Fig. 1. Represents a side view of one of the carriage wheels with its friction wheels attached.

Fig. 2. Is a view of two fore, or two hind, wheels, with the friction wheels, showing the manner in which they are connected.

Fig. 3. Represents the plan of the wagon, showing particularly the manner in which the beds of the two axles are connected. In these three figures the same letters refer to the same parts. A, is the iron wagon wheel, made as usual, except that it is arranged so as to turn on the axle to which it is secured by the linch-pin B, or any other contrivance. C, is a wheel fixed upon the axle as in the common rail-road carriage. D, D, the friction wheels moving upon the axles E, E, and supported by the supports F, F. The whole of these parts are of wrought or cast iron, and the frames are secured together by screws and nuts, so as to keep them solid, and as shown in the figure. G, one of the bars connecting the two frames together, and secured in like manner. H and I are the two frames by which the two beds are connected by a bolt at the point K, equi-distant from the centre of each axletree, the frame I of the hind bed is prolonged, and rests on part of the frame H, immediately over the fore axle, the motion of its end, laterally, being facilitated by a small roller at L.

Fig. 4. Represents the axle detached from the wheels and frames; the shoulders P, bearing against the inside of the frame, keeps the axle in its place.

Fig. 6. Represents the shape of the frames F, F, permitting the axle to rest on the periphery of the friction wheels. In the arrangement here drawn, it is proposed to fix, firmly, the body of the wagon on the hind bed and frame L, to move with it. Another method is, to attach each bed to the body by a bolt at M and N, (fig. 5.) round which the beds must be made to traverse. The frames are then to be connected at O, one having a tooth and the other a socket. These are to be cut of the epicycloid form, which will keep the point of action at an equal distance from each of the centres M and N.

If it be not found objectionable to place the body of the wagon entirely above the wheels, the two friction wheels on one bed may be placed on a common axle. This arrangement will simplify the number of parts, and contribute to the steadiness of the motion.

Plate III. is a perspective representation of the whole carriage.

Observations upon Rail-roads, and the adaptation of Carriages to such as are curvilinear.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

The prospect of a speedy introduction of rail-ways into this country, has very naturally led to the inquiry, whether they be not

HOWARD'S RAIL-WAY CARRIAGE,

Fig. 1

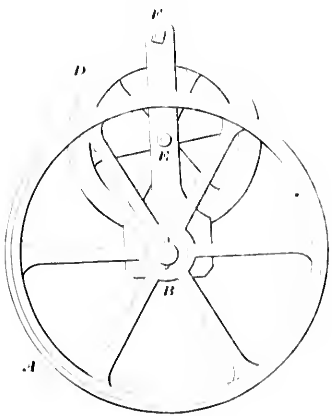


Fig. 2

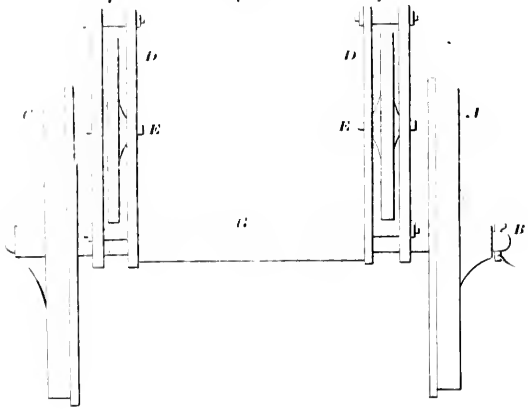


Fig. 1

HOWARD'S RAIL-WAY CARRIAGE.

Fig. 3

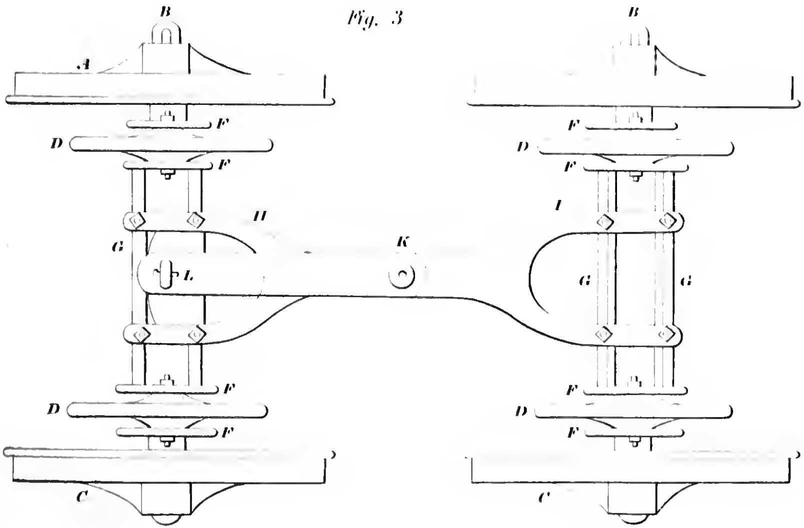


Fig. 5

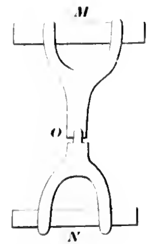
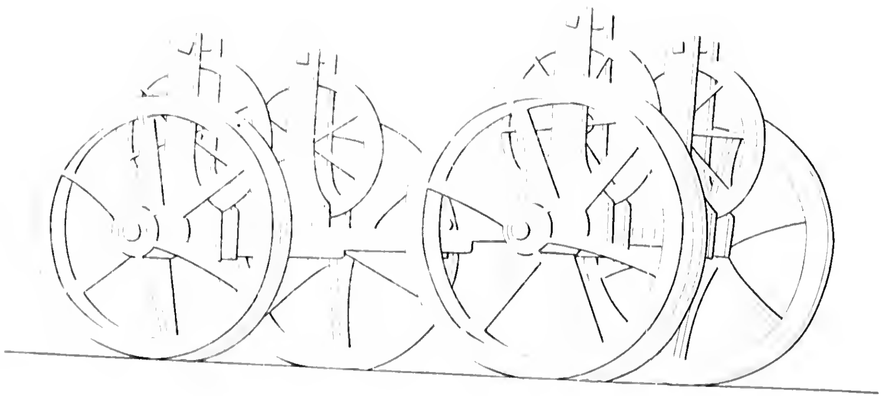


Fig. 6

HOWARD'S RAIL-WAY CARRIAGE.

PLATE III.



susceptible of improvement. Among other imperfections in the present mode of construction, it is said that there is a continual rubbing of the wheels of the carriages against the sides of the rails, which causes considerable resistance, especially if the track of the rail-way deviate from a straight line. It has seemed to me, so far as I can judge from a description of the machinery, that the objection is well founded. All unnecessary friction and resistance, ought certainly to be avoided; and with a view to that object, I take the liberty of suggesting an improvement in the mode of constructing the rails, and carriages.

In the first place, I would adopt the edge-rail, as it is called, and give it a conical shape; and the wheels of the carriages should have, at their periphery, semicircular channels or grooves, of larger dimensions than the rails, as represented in Fig. 1; *a*, being the rail, and *b*, a section of the wheel resting upon it.

Fig. 1.

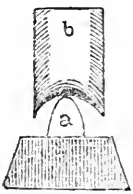
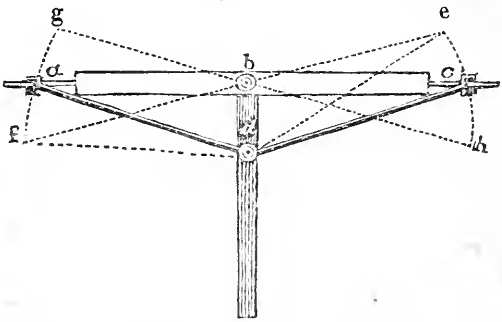


Fig. 2.



In the next place, if the rail-way should deviate from a straight course, I would have the axletree of the forward wheels moveable, upon a pivot at the centre, as in common wagons or coaches. In order to cause this axletree to turn upon the pivot, and to adjust itself according to the direction, or course, of the rail-way, several plans might be adopted. I will suggest a single contrivance, by which the effect may be produced. Let there be moveable knobs or shoulders on the axles of the forward wheels, against which the hubs of the wheels may press: and let there be an arm or lever extending from each shoulder to the body of the carriage, at a point just behind the pivot of the axletree. These arms or levers should be held at each end by a pin, upon which they may turn. When the carriage comes to a curve in the rail-way, if it be to the left, the right wheel will be pressed against its shoulder, which will cause the axletree, by means of the arm or lever, to turn in the direction of the rail-way; and so, vice versa, when the rail-way bends to the right.

In order to illustrate the subject, let *a*, *b*, *c*, Fig. 2, represent the axletree, *b*, the pivot upon which it turns, *a* and *c*, the moveable shoulders, and *a*, *d*, and *c*, *d*, the arms or levers. Now, it must be obvious, that when the rail-way bends to the left, the right wheel will

press against the shoulder c, and cause the axletree to turn in the direction of the rail-way, as represented by the dotted line e, b, f.

Friction may be avoided, and some other advantages may, probably, be gained, as it seems to me, by fixing to each wheel a short and separate axis, which shall revolve with it, the whole to be constructed like the wheel of a wheel-barrow. B.

Petersham, Mass., November 22, 1828.

On Explosions in Steam Boilers. By the EDITOR.

THE following notice of an explosion in a steam boiler, recently appeared in the Pittsburg Gazette, and has been republished in most of the papers in the union.

"*Explosion.*—On Tuesday night, about nine o'clock, one of the steam boilers of the Union Rolling Mill, (iron works,) at the eastern extremity of Pittsburg, on the Monongahela river, burst, with a tremendous explosion, shot off through the air at an angle of about 45 degrees with the horizon, and describing a beautiful arch, fell into the river nearly two hundred yards from the works. The steam being on fire, and issuing from the boiler in a stream of flame, it was beheld with astonishment and admiration by the passengers on board the new steam boat 'Uncle Sam,' which had but a few moments before passed the spot where it descended. The furnace in which the four boilers were situated, being without the wall of the main building, under a slight shed, and the exploding boiler taking a direction outward from the works, no other injury was sustained, than the present loss of the boiler itself, and the displacing of its three companions, which it threw entirely out of their bed, and beyond the floor on which it was erected. The rolling apparatus alone, is stopped by the accident; the hammers and other works were in operation as usual, on Wednesday morning."

With respect to the cause of such explosions, there is not, by any means, a concurrence of opinion, even among scientific men; and the manifest importance of the subject, renders valuable every new fact relating to it, which can be established upon incontrovertible evidence. That highly elastic steam will cause a boiler to burst, and that most of the accidents of this kind which occur arise from the want of strength in the boiler, or the imprudent confinement of the steam, is admitted on all hands; but it has been believed by many, that in those tremendous explosions which occasionally occur, such as that above recorded, the exploding agent is, in part at least, a mixture of those gases, whose bases combine and form water, and that there is an actual combustion of these within the boiler. For ourselves, we have never for a moment entertained such an opinion; and, although we have found among its advocates, some persons not unacquainted with chemistry, we have never met with, or been able to elicit, any admissible rationale of the formation of such a mixture; nor do we recollect among the accounts of such explosions, which

have appeared, any one, excepting the foregoing, which seemed to justify the opinion of a gaseous combustion. Whether the evidence in the case before us possesses sufficient strength to add probability to this opinion, we shall presently inquire.

In our second volume, page 147, there is a letter to the Editor, from Professor Hare, in which he has examined this subject, and drawn the conclusion, that the production of explosive gases, is contrary to the well established principles of chemistry. To this article we refer our readers.

A valuable paper, by Mr. Perkins, on the same subject, may be found in our third volume, p. 417. We thought that there was great force and consistency in the theory of that gentleman, and we have not yet seen any reason to change this opinion. We do not think it necessary to repeat what was there said, as it is in the hands of our subscribers; those who feel an interest in the inquiry, may turn to it with advantage.

In the Pittsburg account, the idea of the burning of the steam, is no more rational, than would have been the apprehension that it might "set the river on fire." Steam is as incombustible as water; indeed, it is water in an attenuated state. The opinion, that steam itself burns, when water is thrown upon combustibles, appears to be one of those vulgar errors, which are the result of trusting too much to the senses; those principal, but often false, guides of the uninformed. When water in moderate quantities is thrown upon a brisk, and flaming fire, it is converted into steam, which, expanding and mixing with the flame, causes it to spread out into a much larger volume than it would otherwise have occupied, and thus *apparently* increases the combustion. If it acted in any other way than that stated, the water must be decomposed and recomposed at the same instant; and how, in that case, it could increase the heat, we should be puzzled to tell.

Passing over the statement of the burning of the steam, as only evincing a deficiency in chemical science which is by no means extraordinary, or disreputable, we can well imagine how the appearance of that combustion was produced, which, had it really existed, would have proved the formation of explosive gases within the boiler. We are of opinion that the boiler was heated to redness at one end, and that the meteor-like appearance which it exhibited, was merely the rapid passage of the projected boiler through the air. To the eye, this, like the whirling of an ignited coal, would present a lengthened stream of light, and apparently justify the conclusion that there was a real combustion.

Had this accident, or any of those similar to it which have occurred on board of steam boats, been the consequence of the combustion of explosive gases, a volume of flame would have filled the vessels; linen, and other light articles, would have been set on fire, and persons, instead of being scalded by steam, would have been scorched by fire.

As regards the force of the explosion, there is no reason why it should not have been produced by steam alone. If the steam gun

constructed by Mr. Perkins, should never be brought into actual use, it will have evinced, experimentally, that projectiles may be thrown by the elastic force of dense steam, with a power equal to that of gunpowder. It is not necessary, therefore, in order to account for the effects produced, to resort to any other agents than those which are known to be present, heat and water.

If we ever devise means for obviating such accidents as those of which we have been speaking, we must first acquire correct information respecting the facts attending them, and not adopt vague assumptions, as admitted truths; we must either proceed upon established principles, or discover reasons for correcting our theory. Before assuming that the ignition of gases is concerned, let us hear how these gases are produced. If the oxygen of the water could be made to combine with the iron of the boiler, the hydrogen would be altogether incapable of producing an explosion, without admitting a large portion of atmospheric air; which air must find its way into a vessel in which there was a large quantity of vapour and gaseous matter in a state of tension, and exerting a pressure outward, much greater than that of the external air.

It is believed that these violent explosions take place only when the boiler is without its proper supply of water. If such be the fact, the desideratum is the means of always furnishing this supply; an object which does not appear to us to present any insurmountable difficulty.

We invite attention to this subject, and particularly desire of those who have studied chemistry, and who advocate the opinion which we have opposed, to explain the process by which they imagine a boiler can become charged with oxygen and hydrogen, or any other explosive mixture of gases.

Franklin Institute.

The Twentieth Quarterly Meeting of the Franklin Institute was held at their Hall on the 15th January, 1829.

James Ronaldson, Esq. president, in the chair, and

William Hamilton was appointed secretary, *pro tem.*

The minutes of the last quarterly meeting, and also of the meeting held this day at 4 o'clock, to appoint the tellers of the annual election, were read and approved.

The quarterly report of the board of managers was read and accepted, and on motion referred to Messrs. S. V. Merrick, Walter R. Johnson, and Thomas Fletcher, as a committee to publish such parts as they may deem expedient, in the Journal of the Institute and the public papers.

On motion, it was unanimously

Resolved, That the board of managers, in assuming the publication of the Franklin Journal, as the Journal of this Institute, have, in the opinion of this meeting, acted in strict conformity with the in-

terest of this society, and that their proceedings in this matter be, and the same are, hereby approved.

The tellers reported the following gentlemen as duly elected officers of the Institute, for the ensuing year, viz.

PRESIDENT, James Ronaldson.

VICE PRESIDENTS, { Isaiah Lukens, Thomas Fletcher.

RECORDING SECRETARY, Algernon S. Roberts.

CORRESPONDING SECRETARY, Isaac Hays, M. D.

TREASURER, Samuel V. Merrick.

MANAGERS.

John Harrison,	Mordecai D. Lewis,
Abraham Miller,	Charles H. White,
Isaac B. Garrigues,	George Fox,
Adam Ramage,	Andrew Young,
Ashbel G. Ralston,	Christian Gobrecht,
Rufus Tyler,	Thomas Scattergood,
John Struthers,	Thomas M‘Euen, M. D.
John O'Neill,	Thomas Loud,
M. W. Baldwin,	James Rowland, jr.
Joseph H. Schreiner,	Frederick Fraley,
Samuel J. Robbins,	Benjamin Reeves,
Henry Horn,	William Yardley, jr.

JAMES RONALDSON, *President.*

Attest, WILLIAM HAMILTON, *Secretary, pro tem.*

Fifth Annual Report of the Board of Managers of the Franklin Institute.

To the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, the Board of Managers make the twentieth Quarterly Report.

IN surrendering to the Institute the powers delegated to them, it may not be improper for the board to take a brief review of their transactions during the past year, without confining themselves to the last quarter only.

When the Franklin Institute was first projected, its founders opened a field for its influence, varied and extensive; embracing, as they thought, all the objects which came within their view, as tending to benefit their fellow mechanics, for whose use and welfare it was organized.

In common with all new and popular institutions, at their commencement, the zeal of those intrusted with its concerns, prompted them to devote more time to its interests, than, in just accordance with their private duties, the infant institution was entitled to.

When once firmly established, and the extent and laborious nature of their duties became known, the board were induced to look for some means, by which their personal attention to the various details necessarily growing out of so large an institution, might, in some

measure, be dispensed with, while their energies would be more directly employed in forwarding its interests, without abstracting too much from their own time.

With this view, in the fall of 1825, they employed a clerk, whose duty it was to keep the records of the board, of committees, and assist the treasurer.

After two years' experience, it was found that this officer could not fulfil the intent of the board, for, although his duties were executed as required, he could not, without devoting his time exclusively to the Institute, perform any service to the treasurer, who, for several months in the year, was liable to be employed in the service of the Institute, at any moment during the day, and the treasurer could not command his own time. After due consideration, the board determined that the affairs of the Institute could not be performed, with justice to its best interests, without the whole time being devoted to them, of some one well qualified to the office, whose feelings toward the Institution would prompt him to take an interest in its prosperity, from other motives than the mere compensation he might receive.

They, therefore, determined to create an officer called the Actuary, whose duty it should be, to act as secretary to the board and standing committees, in conjunction with the curators, to have charge of all property of the Institute, collect all money due the society, and account for the same, and in compensation, to receive a commission on all receipts into the treasury.

The board selected, in April last, for this important and responsible office, Mr. William Hamilton, a gentleman well qualified for its duties, in the performance of which they have every reason to be well satisfied.

The sources of compensation above stated, from the funds of the Institute, it must be evident, could not be a remuneration to any gentleman devoting his whole time to its service; the board were, therefore, obliged to seek some other source, from which they might obtain the means for this object, and at the same time extend the benefits of the institution.

The publication, by the Institute, of the Franklin Journal, appeared the best calculated to effect their object, and was, therefore, under agreement with the editor, assumed, not under the expectation of profit, but with the double object of furnishing compensation to the actuary, and increasing the library of the Institute, by exchanging with other periodical publications.

After a trial of one year, although the accounts are not yet closed, little doubt remains but that the Institute will suffer a small loss by the operation.

Your board, however, are of opinion, that this loss has been amply repaid by the advantages the society have gained, first, in the services of the actuary, and secondly, in the increase of the library, for which they exchange with 12 periodicals. They have, therefore, determined on its continuance, and beg leave earnestly to recommend to the Institute, that it receive their cordial support. This work, originally published by Dr. Jones, under the patronage of the

Institute, has completed six volumes, and the board do not hesitate to say, that no work devoted to mechanics has ever, in this country, taken so high a stand among its cotemporary periodicals. The abilities of the gentleman who edits it, are known to you all; and since he has been called to take charge of the patent office, at Washington, and his means of information extended, a marked improvement has been visible on its pages.

The editor's official station, gives him an opportunity of noticing all patents which are taken out, and this is done without filling the work with useless legal or technical verbiage; but by an abstract of the specification, sufficiently voluminous for a just knowledge of the invention described, accompanied by the editor's remarks, supplied from a fund of mechanical information, surpassed by few. That the character of the work will rapidly improve, there cannot be a doubt, when it is recollected that it has only been a few months since the editor has become settled in his new abode, and enabled to systematize his own time and operations.

With a view of more distinctly identifying the journal with the Institute, the board have resolved to alter its title, and, hereafter, it will be published as the *Journal of the Franklin Institute*, of the state of Pennsylvania, devoted to the mechanic arts, manufactures, general science, and the recording of American and other patented inventions, new series, edited by Dr. T. P. Jones, published by the Franklin Institute, at their hall. Thus the journal becomes identified with the Institute, and it behooves all those who take an interest in its prosperity, to assist in the support of their journal, not merely in a pecuniary way, by subscribing, but intellectually, by lending their aid to increase the interest in its pages. Such a work coming from an institution bearing so high a character as the Franklin Institute, ought not to depend on foreign journals for matter to fill its pages. It is never to be expected that an editor can furnish matter for a periodical, from his own pen; and that the work has not, heretofore, maintained the character of originality, is our fault, not his. The board confidently call on the Institute, to make this work what it ought to be, an original work of the highest standard. Every step of its advancement tends to shed additional lustre on the institution that produces it. Let it be *emphatically, the Journal of the Franklin Institute.*

Since the period for which your board have had charge of the affairs of the Institute, they have been deprived of the services of their able professor of Mechanics, Dr. T. P. Jones, so well known and respected by all for his urbanity and gentlemanly deportment, whose zeal for the cause of mechanics, was only surpassed by his knowledge, from which the Institute drew forth abundantly. His situation has been filled by W. R. Johnson, A. M. the present winter, to whose instruction no one can attend without interest and profit. The board consider themselves fortunate in being able to fill this vacancy so worthily, and with so much satisfaction to the attending members, of whom there is an unusually large class.

The regular lectures by professors Bache and Johnson, com-

menced on the 19th of November, and with a view of enhancing their value to the minor class, a regulation has been adopted, the benefit of which is found to be great. Heretofore, the hall of the Institute has been opened for the small sum of one dollar each to the sons and apprentices of members. This regulation, intended as a benefit to the rising generation, proved a nuisance; for while a part of the lads paid attention to the instruction offered them, very many made the lecture room a place of amusement, to the annoyance of the older part of the audience. To avoid this difficulty, it has been made a part of the course of instruction for each professor to examine, before the lecture, the lads indiscriminately, on what they have learned the lecture previous. Thus an honourable emulation is excited among them, and instead of a place of amusement, the hall of the Institute has become to them what it ought to be, a place of instruction. To assist the pupils, the board have adopted Conversations on Natural Philosophy and Turner's Chemistry, as text books, and recommended them to the lads.

The volunteer lectures have been maintained with spirit and interest. To Peter A. Browne, Esq. the Institute are much indebted for a course on geology, which that gentleman is now engaged in delivering on Saturday evenings. Geology is a subject which he is well qualified to teach, and one of peculiar interest at this moment, while a proposition for a geological survey is now before our state legislature; the plan, of which Mr. Browne is the author, deserves the particular attention of all who take an interest in the welfare of the state. The result of the survey will be, if completed, to lay open the mineral resources of our state, and exhibit the exhaustless riches which nature has bestowed upon us, and give a proper direction to those energies employed in their development.

Mr. Leib has delivered several lectures on mathematics and perspective, subjects of deep interest to every mechanic. They were heard with pleasure and gratification by his numerous auditors.

The drawing school, under the charge of Messrs. H. Bridport and George Strickland, has presented gratifying results; 30 to 40 students being in regular attendance.

The mathematical school was recommenced in November, under very favourable auspices, by Mr. Sears C. Walker, a gentleman highly recommended for his abilities. The number of scholars has not been reported.

The High School continues to enjoy an increased share of public favour. There are, at present, near 200 scholars within its walls, whose rapid improvement evinces the excellence of their instruction and utility of the system. For details respecting this school, reference is made to the committee of instruction, under whose care it more especially is, and who will report after the examination, at another season of the year.

Of the 5th annual exhibition, which was held at the usual season, the board refer you to the report of the committee read at the last quarterly meeting. The detailed report has been delayed, from

causes beyond their control, but it is now in a state of forwardness, and arrangements for its publication will be early made.

To the library of the Institute, several valuable additions have been made, of periodicals, and two works of importance, the Encyclopedia, Manufactures et Arts, and Encyclopedie Arts et Metiers, received from the Academy of Natural Sciences, in exchange for some duplicates. To this branch of the Institute, the board call your particular attention, and that of their successors.

That it has been so much neglected, is attributable to the want of means within the command of your officers, which would enable them to place it on a respectable footing. The opportunity for a gradual increase is now within our reach, through the medium of the journal. The board regret to state, that no donations of value have been received during the past year, but hope when the nucleus now formed shall be properly arranged, additions from this source may be received. The library of the Franklin Institute is of great importance, and, as such, should be carefully nurtured.

For the cabinet of minerals, a case has been provided, through the liberality of Dr. J. R. Coxe, and the collection belonging to the Institute, placed under the charge of professor Bache, who has volunteered to arrange them. The collection is yet small, but contains many important specimens.

The most valuable of the Institute's models, are in good preservation, and arranged in the third story. Those of the several orders of architecture, have been injured; but the committee have taken measures for their restoration, and when repaired, will be placed in safety.

Owing to the dissatisfaction expressed by the Circuit Court, occupying the second floor, at the manner in which the girders were sustained, the board have caused each floor to be supported by four substantial cast-iron columns. Those in the lecture room, resting on birch piers, from the cellar, and each standing on a cast-iron base, 14 inches square. The building is now rendered entirely free from the slightest suspicion of insecurity.

Your board have also caused the railing in front to be finished, which entirely removes the nuisance complained of in the alley ways. Some further improvements will be necessary, next spring, as the paint in the interior has become discoloured and the plastering tarnished. These details they recommend to the attention of their successors.

The treasurer's annual report, is herewith presented; balance, $183 49.

The board now beg leave to surrender into the hands of their constituents, the powers delegated to them, in the hope that the acts of their administration will meet your approbation.

All which is respectfully submitted by order of the board,

SAMUEL J. ROBBINS, *Chairman.*

WILLIAM HAMILTON, *Actuary.*

Philadelphia, January 15, 1829.

On the conversion of Cast-Iron into Plumbago, by the action of the Pyro-ligneous Acid.

Mr. W. H. Pepys lately exhibited to the Editor, a piece of cast-iron pipe, which had become completely converted into a substance greatly resembling plumbago or black lead, as it was soft enough to be readily cut by a knife, and would make dark shining traces upon paper; Mr. Pepys said the change was effected by the action of the pyro-ligneous acid upon it. A similar fact has, still more recently, been mentioned to the Editor, by Mr. Evans, of Queen Street, Cheapside; who, in his patent process for roasting coffee, in driving off the acid vapours, at first employed cast iron pipes for conducting them away, and discharging them into the atmosphere; he, however, found that these pipes became converted, by the action of the hot acid vapours, into plumbago; and, in consequence, he has been obliged to substitute, in place of them, earthenware pipes, made of the Vauxhall ware, and which answer perfectly. [*Tech. Rep.*

On distilling Alcohol from Blackberries and Raspberries.

Mr. Evans lately showed the Editor a specimen of very fine, and pure alcohol, which he stated he had distilled from a very common and well known English vegetable, which he had never before known to be applied to this purpose. The alcohol had the flavour of French brandy. Mr. Evans said, that an experiment was now making, on a large scale, in North Wales, to cultivate the bramble for this purpose; that it readily grew from cuttings planted in a good soil, and which produced fruit the same year; they were to be trained on low frames, to prevent them from trailing upon the earth, and the berries were greatly increased in size from the culture. He does not intend to patent his discovery, but to exercise it for the public benefit.

We think that the raspberry, particularly the large Antwerp varieties, would, also, answer exceedingly well for this purpose, as the fruit they produce, contains a great abundance of saccharine matter. [*Ib.*

LIST OF FRENCH PATENTS

Granted in the last quarter of the year 1827.

To Souffrant, Barthelmi, mechanic, of Paris, for a pump he calls a French pump, to supersede steam engines—15 years.

To Fastemain, Pierre Nicolas, of Sononches, for a reaping machine—15 years.

To Bourrouse de Laffore, Joseph Bonaventure, of Agent, for a process to learn to read in a short time, he calls "Statcligie"—10 years.

To Bn. Cagnaird de Latour, of Paris, for a process to apply the several sorts of Lava, to purposes as yet unknown—15 years.

To Capdeville, Charles Antoine, of Lugos, for improving cast-iron by employing raw heath root—10 years.

To Spiller, Joel and Crespel, Delisse, Louis Francois, Xavier Joseph, of Paris, for employing steam in the manufacture of beet-root sugar—5 years.

To Cleusman, Jean Baptiste, of Paris, for a piano, wherein the pins and dampers are different from other pianos—5 years.

To Lepine, Jaques Nicolas, of Paris, for a portable gas apparatus —10 years.

To Segundo, of Paris, for improved bits for horses, &c.—10 years.

To Petite Pierre, Jean Henri, of Paris, for a metotachygraphique mould box to cast characters for music—15 years.

To Aschermann and Perrin, Paris, for a cutting machine to shave the hair from hides for hat manufacturing—10 years.

To Louis Junior, Francois, of Nimes, for improvements in the looms, "a la jaquart"—10 years.

To Lebarby Pierre, of Paris, for a means to suspend and prevent ruptures—10 years.

To Muirial Etienne, of Lyon, for woven stuffs imitating engravings, typographies, &c.—10 years.

To Conrad, Philippe Henri, and Adhemar Louis Joseph, of Paris, for a process to manufacture bricks—10 years.

To Steininger, Francois, of Paris, for a mechanism principally applicable to the bass-viol—5 years.

To Didot, junr. Firmin, of Paris, for a process he calls lithotypographique, to print with moveable letters—5 years.

To Lorget, Albert Louis, of Paris, for a process to manufacture paper imitating enamel—5 years.

To Leistenshneider, Ferdinand, of Poncey, for manufacturing paste-board—5 years.

To Bourquin, Abraham Henri and Company, of Lyon, for a mechanical weaver's shuttle—5 years.

To Mallic, Charles, and Memo, Fleuri, of Lyon, for a mechanical loom batt, in weaving ribands, &c.—5 years.

To Berthet, Claude and Cacheux, Victor, of Paris, for a clock escapement—5 years.

To Beauvais, Francois, of Lyon, for a metallic composition he calls "argyroide," susceptible of the polish of steel—5 years.

To Saint Maurice Cabang, of Paris, for a copying press, or secretary—5 years.

To Rodier, junr. Denis, of Nimes, for processes to give various workmanship to silk, wool, and cotton—15 years.

To Mialle Simon, of Paris, for a method to teach to read in a few lessons—15 years.

To Dumoutier, Bon Pierre, of Pantin, for manufacturing hydraulic lime—15 years.

To Montagny, Jean Pierre, of Paris, for manufacturing buttons of all colours and dimensions, imitating silk buttons—5 years.

To Lepine, of Paris, for a horse collar and saddle—5 years.

To Boutain, Charles Toussaint, of Paris, for double spectacles, he calls "binocle a tirage simultane"—5 years.

To Bridier, Royer, of Sedan, for a malt mill—10 years.

To Croisat, Ferdinand, of Paris, for a hair brush—5 years.

To Guilbout, Alexander and Bondot, Vincent, of Paris, for a system of machinery for roving and drawing silk, cotton, &c.—5 years.

To Gaulofret, junr. Joseph, of Marseille, for a process to revive animal coal—10 years.

To Arizolli, Barthelemi, Francois, of Paris, for cast-iron chimneys—15 years.

To Comte de Rochelines, Jean Baptiste Richard, and Fabricius Leonard, of Douai, for a mechanism to prevent the upsetting of coaches—5 years.

To Bernardiere, Achille, for manufacturing fine baskets, &c. with whale bone--5 years.

To Richard, Jean Jaques, of Paris, for manufacturing divers articles in cast-iron instead of cast steel—5 years.

To Collain, Jean Pierre, Francois, of Sabrian, for a serpentine chimney and fire-place in union with a boiler—15 years.

To Irving, of Paris, for applying the atmospheric pressure and vacuum to produce a rotary motion—10 years.

To Boulet Jacques, of Paris, for a process to strengthen carded and combed wool, &c.—15 years.

To MM. Canson, brothers, of Annonay, for a process to size paper in the vat—10 years.

To Simon Nicolas, of Saint Die, for a portable kitchen-garden—5 years.

To Prudel Pierre, of Carcassone, for a cloth shearing machine—10 years.

To Siau Barthelemi Gaulofret, junr. and MM. Boffe, brothers, Melchoir Francois and Jean Baptiste, of Marseille, for a process for manufacturing glue from gelatine—5 years.

To Becker, Henri Guillaume, of Strasbourg, for a new high pressure locomotive steam engine—10 years.

NOTICE TO SUBSCRIBERS.

Our subscribers will perceive that a slight alteration has been made in the title of this Journal. The Franklin Institute having assumed the publication of this work in January, 1828, they have determined to give it such a title as would mark its immediate connexion with the Institute—new title pages are furnished with this number, which the subscribers will please substitute in the place of those formerly issued, with the two volumes already published for the past year. This number, therefore, will commence the third volume of the new series.

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania;

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

FEBRUARY, 1829.

On the Natural History of the Honey Bee, and the importance of its products.

[Extracted from the North American Review, for October last.]

[CONCLUDED FROM PAGE 43.]

The little work, the title of which we have prefixed to this article, called "The Farmer's Manual," contains, in a small compass, as much of the minutiæ of the *management* of bees, as is necessary to the common cultivator. Mr. Butler is a sensible, practical writer, as well on other branches of rural economy, as on bees, and we would recommend his book to all who are engaged in those pursuits; for, with some slight deviations from his rules, such as a different climate would indicate, his experience may be beneficial to all.

We esteem it a very desirable object to make the care of the bee more common than it has, hitherto, been, in this part of the country. With the exception of a small one under the superintendence of the society of the Shakers, established at New Lebanon, we neither saw, nor could we hear of more than a single apiary, on a journey last summer to Lebanon Springs, although we made many inquiries. Never was there a country more suited to the cultivation of bees. Even in August, there is an abundance of white clover, and small springs and shallow rivulets appear at every turn. There is no doubt that bees were, formerly, more frequently kept in America, than at present. In many places in New Jersey, where there is now scarcely a bee to be seen, there once existed millions of these insects, to the great profit of their owners. It was common for one dealer in a country town, to sell from fifteen to twenty barrels of strained honey alone, to say nothing of wax and comb-honey, as well as a

kind of wine, made of the washings of combs, called *metheglin.* These articles of commerce, have almost disappeared, and we find that it is mainly attributable to the ravages of the millers, or night-moths, which have of late years spread destruction through the hives.

The attention of naturalists has been directed to the history of this fatal enemy of the bee, and many attempts have been made to construct hives that would prevent the miller from depositing its eggs in them; but the plans were defective, because there was no contrivance for inspecting the hives. Before we close this article, we will endeavour to give a description of a hive, that is so constructed as to enable any one to see the interior, and to free it from all extraneous matter, as well as to protect it from the inroads of the night-miller.

On the general subject of the care of bees, the following remarks, the result of personal experience, may be acceptable to the reader.

The situation of an apiary, is of little importance. We have seen bees thrive as well with an eastern, as with a northern aspect.

If the entrance of the hive face the north, the bees may, possibly, be detained within, a minute or two later in summer; but this is more than counterbalanced, by the same cause operating in winter, when it is desirable that the bees should remain in the hive. But, for ourselves, we have seen no difference in the time of quitting the cells, between those that faced the north, and those that had a southern exposure. Nor have we observed that there is any difference in the welfare of hives, as placed in valleys or elevated on hills, meaning, of course, hills of thirty or forty feet in height.

We have seen hives prosper, adjoining a stercorary, and, oftentimes, near a piggery. We have known colonies of bees to exist for a term of twenty years, with no other protection from the heat and cold, than the top of the hives. They have multiplied equally well under an open shed; but as a free circulation of air is necessary to their health and comfort, we have never known them to thrive when quite enclosed. A house, therefore, strictly so called, which is shut on all sides, may serve to amuse the observer for a year or two, but there must be an extraordinary combination of fortunate circumstances, if the bees increase, while confined in it.

It is better to begin with a single hive, and so attain a knowledge of the habits and instincts of the bees, by degrees. We have known several persons, who have purchased a number of hives at once, and relinquished the pursuit, from the perplexity that ensued when the swarming season commenced. But there is no similar occupation so easily followed, and none that requires so little capital, as that of keeping bees. The profit is enormous. If a person, well trained to the employment, should follow the plan adopted in some parts of Europe, of removing the bees from place to place, in a kind of ark on a river of some length, thus providing a plentiful supply of food, he might increase his stock to any extent.

An apiary of twenty hives, could maintain itself in an area of a mile, where there is plenty of blossoms. Every farmer should, however, provide pasture for his bees, as well as for his cows; and,

therefore, when the spring and summer flowers are gone, he should have a field of buckwheat ready, which, although not so palatable as other flowers, will serve the bees for winter food.

An apiary, or bee-shed, should be, at the eaves, about four feet from the ground, with a roof sloping both ways, and with any aspect that the owner chooses. It should be ten feet wide, and the length of it should be increased, as the hives multiply. It is, however, difficult to describe one accurately.

The most convenient one that we have seen, is on a farm near New Brunswick, in New Jersey. It is fifty feet long, and contains sixteen hives on each side. The swarms which are successively cast off, are placed under the same shed in the winter, and an equal number of the old hives are sold, to make room for them. This apiary might be enlarged to any extent, were there pasture enough for the bees; but the area of the bees' flight, as there are now many cultivators of bees in this district, does not furnish food enough for a great number.

In this apiary, the miller, or night-moth, is successfully guarded against. A small wire door, made to slide behind two door-posts, formed of needles, is closed over the entrance of the hive, as soon as the bees have retired for the night. This is done during the months of April, May, and June; after that, if the weather sets in warm, and the bees are oppressed by heat, the floor of the hive is let down, which, as it is fastened to the hive behind, with hinges, and on the sides with hooks and staples, can easily be accomplished. Two rows of scantlings, or joists, four inches square, and running the whole length of the apiary, receive the hives between them, which are thus suspended at a distance of about three feet from the ground.

The hive is thirteen inches square at the *top*, and is of the same size at the bottom of the front and back, but the bottom of the *sides* is only seven inches wide. By this slope of the hive, the combs wedge themselves as they are made, and there is no use for the ill contrived crossed sticks, that are generally thrust in the old hives, to keep the combs from falling down by their own weight. The floor is, as we observed, fastened by hinges and hooks. It is, likewise, an inclined plane, having a slope of at least four inches.

The advantages of this inclination, will be instantly seen. The perspiration of the bees, which is copious, is, by the inclination of the sides and floor, conveyed off at once, without being absorbed by the boards. All extraneous matter can be carried away by the bees, with very little trouble, and they can defend themselves from robbers, or corsair bees, with much greater ease than if the floor were flat.

As the floor opens and shuts, the observer can inspect the interior of the hive at pleasure, not with the hope of getting at the minutiæ of the bees' policy, but to see the forwardness of the combs, the number of the bees, and the general appearance, which a practised eye can soon understand. When the floor of the hive is left down all night, and the bees hang very low from the combs in the

morning, they will soon remove themselves up again, if the floor is raised very gently and slowly, and fastened as usual.

The cover of the hive is, of course, thirteen inches square. It is made of common pine, as is the hive, with two cleats on the upper part, as well to prevent the board from warping, as to prevent the box, or upper story, which is always added, from being moved from its place. The cover of the hive has three holes, of one inch diameter, within a quarter of an inch of each other. These holes are to allow the bees to pass to the upper box, when the *hive* is full of honey.

It is ascertained, satisfactorily, that the young brood and the bee-bread, or pollen, are deposited in the hive where the swarm is first put. The holes in the cover are, therefore, kept shut by plugs, until the hive be filled. The holes are then opened, the bees immediately pass up, and if the season be propitious, they fill the upper box with comb and honey, which, as there is neither brood nor bee-bread, is of the finest and purest kind.

We have often seen forty and sixty pounds obtained by this simple proceeding; and the box is also used to feed a famished hive, in the spring. A single comb left in one of these boxes, will sustain a swarm, that has eaten up all its honey, until vegetation commences. As the boxes and hives are of equal size, any one box will fit a hive.

When the combs in the hive are three years old, two of them can be taken out every winter, provided there remain honey enough in the rest, for the use of the bees. Thirty weight of honey is the average quantity that suffices for a swarm of large size. The hives in question weigh, when empty, about twelve pounds, a swarm of bees, four pounds, the wax, two pounds. The whole, therefore, ought to weigh about fifty pounds, in November. All over this quantity, can be taken out to advantage, as the wax becomes very dark after two or three years. The whole of the combs can be thus renewed in the course of four years, as the bees replace them early in the spring. We omitted to mention that the length of the back of the hive, is twenty-two inches, and of the front, twenty-eight inches, and that the floor projects in front about three inches, thus forming an apron, or platform, on which the bees alight before they enter in at the little door. Models of this hive have been sent to several of the horticultural societies of Europe, and they are getting into use in this country.

When a swarm is to be hived, the hive is put in a moveable frame, which is easily carried to the tree where the swarm hangs, and this is proved to be the easiest method of hiving swarms; as the screws are taken out of the cover, and the hive lifted up to the swarm, into which they are shaken. The frame and hive are then placed on the ground, and the cover is *gently* laid on and screwed fast to the hive. Little sticks are put against the apron, and rest on the ground, serving for ladders for those bees that fell to the ground, when the main body was shaken into the hive. Bees, from the moment of their leaving the hive, when swarming, until they are fairly settled and at work in a new habitation, seem stupid and confused. This arises,

however, from the precarious situation of their queen. If she fall into the hive when the swarm is shaken in, all the remaining bees will soon find their way to the entrance; for a peculiar sound is emitted by these insects when their queen is present. If, however, she remain on the limb, it will be necessary to shake it again over the hive, as the bees will leave it to fly up to the place where the queen is. When the bees are quiet in the hive (which is ascertained by the number that are seen hovering in front of the entrance, on the wing, and by others ventilating the hive with their wings,) the top can be covered with a sheet, doubled several times, to keep off the heat of the sun. The hive must remain in the same spot, until eight or nine o'clock in the evening, when two persons can quietly and gently convey it, frame and all, to the apiary, and place the hive, with great care, between the joists where it is permanently to remain.

Hives should be made and painted a year before they are used, as the smell of paint is disagreeable to the bees. The smoother the boxes and hives are, inside and outside, the better both for the health of the bees and for preventing the deposit of the eggs of the miller. We must except the *roofs* of the hive and of the box, as they should be rough; for we have ascertained, that the propolis, or bee-glue, does not adhere so closely to a smooth surface at all times.

And here we would remark, that it has been the custom, from the earliest ages, to rub the inside of the hive with a handful of salt and clover, or some other grass or sweet-scented herb, previously to the swarm's being put in the hive. We have seen no advantage in this; on the contrary, it gives a great deal of unnecessary labour to the bees, as they will be compelled to remove every particle of foreign matter from the hive, before they begin to work. A clean, cool hive, free from any peculiar smell or mustiness, will be acceptable to the bees; and the more closely the hive is joined together, the less labour will the insects have, whose first care it is to stop up every crevice, that light and air may be excluded. We must not omit to reprehend, as utterly useless, the vile practice of making an astounding noise, with tin pans and kettles, when the bees are swarming. It may have originated in some ancient superstition, or it may have been the signal to call aid from the fields, to assist in the hiving. If harmless, it is unnecessary; and every thing that tends to encumber the management of bees, should be avoided.

Straw hives are unsuitable to our climate, and afford a harbour for all kinds of insects. It is folly to talk of their cheapness. If a man intend to keep bees, he must, in the first place, make the hives in the very best manner; by this we mean, of good materials and of good workmanship. A hive badly joined, by an awkward carpenter, is worse than a hollow tree. One half of the labour of the bees, is directed to the repairs of their dwelling.*

* A model of the hive which we consider of the best construction, may be seen at the village of the Lebanon Shakers, in the hands of Mr. Daniel Hawkins, or at the seat of Theodore Sedgwick, Esq. in Stockbridge. The inventor of this hive has had an opportunity of judging of its merits, by experience.

It is not asserted that the bees will, of themselves, fall into these hives, or that no trouble or expense is necessary in the management of an apiary. We know that both care and expense are required; but the latter, after the first disbursement, is very trifling. Vigilance and neatness, are for ever in requisition, and the care of bees, like all other profitable business, cannot be pursued to any advantage, unless it receive daily and minute attention. But have we not accomplished a great deal when we have reduced the thing to this certainty?

But, although, as we have before observed, nothing is more simple in theory and practice, than the history and care of bees, yet it requires a constant and unremitted attention, if we aim either at instruction or profit. Can any thing be done well and to advantage, without these? Varro, in his treatise *de Re Rusticâ*, is the first who has spoken of *hives*. He wrote upwards of 1870 years ago; and how many different sorts of hives have been constructed since his time, to say nothing of the different theories? We wish to see bees in every garden throughout America, but we have no desire to see the subject encumbered with more than is necessary to advance the pleasure and profit of the pursuit. To the naturalist, we will leave discussions of organization and propagation. They are foreign to our purpose, as they only serve to perplex and deter us from the main points. But it is proper to know the most simple mode of managing a hive, and this includes the pasture, or food, that is necessary for its sustenance. Hunger destroys as many bees as the miller. We ought to cultivate such shrubs and plants as the bees like; without this, they will starve. The American black willow, and the red maple, are the first trees that are visited by the bees. They are fond of the crocus, which is the earliest of our bulbous roots; and these we can have in abundance, as they multiply quickly and occupy little space. They are beautiful in themselves, affording a rich treat to the eye; and they flower so early, and are of such bright and vivid colours, that we take as much pleasure in them as the bees do. The stercorary and piggery, are next resorted to by these insects. These, we presume, are their medicine shops, and the extract absorbed from them, must be used as a tonic. Blossoms of all kinds, excepting those of the red clover and of the honey-suckle, are excellent food; and the bees especially profit by the increased attention bestowed, at present, in some parts of this country, on the cultivation of the peach-tree. They not only drink the nectar and abstract the pollen of the flower, but they appropriate the peach itself. We have seen twenty or thirty bees devour a peach in half an hour; that is, they carried the juices of it to their cells. The humming-bird alone, can reach the bottom of the nectary of the honey-suckle, but even here the instinct of the bee is seen. The small birds, such as the wren, make an incision on the outside, near the bottom of the flower, and extract a part of the juices. The bee takes advantage of this opening, and avails itself of what is left.

The scent of the bees is so acute, that every flower which has a powerful odour, can be discovered by them at a great distance.

Strawberry-blossoms, mignonette, wild and garden thyme, herbs of all kinds, apple, plum, cherry; and, above all, raspberry blossoms, and white clover, are delicious food for them, and a thriving orchard, and garden, and apiary, fitly go together.

But, as the bee seeks only its own gratification in procuring honey, and in regulating its household, and as, according to the old proverb, what is one man's meat, is another's poison, it sometimes carries honey to its cell, which is prejudicial to us. Dr. Barton, in the fifth volume of the American Philosophical Transactions, speaks of several plants that yield a poisonous sirop, of which the bees partake without injury, but which has been fatal to man. He has enumerated some of these plants, which ought to be destroyed wherever they are seen, namely, dwarf-laurel, great laurel, kalmia latifolia, broad-leaved moorwort, Pennsylvania mountain-laurel, wild honey-suckle (the bees, as we observed, cannot get much of this,) and the stramonium, or Jamestown-weed; which last we should wish to see completely eradicated, as, independently of the poison extracted from its flowers, and from its seeds, which are often eaten by children, it is the ugliest weed that grows, and has the most offensive odour.

The poets, always exalting and magnifying the subjects that they touch, have contributed, perhaps, more than any other set of writers, to mislead our judgment. They endow the bee with memory, and Rogers thinks that it finds its way to the hive, by this faculty alone. Nor is it only with regard to the bee, that poets, the worst entomologists in the world, have led us astray.

Cowper says,

> "I would not enter on my list of friends,
> Though graced with polished manners and fine sense,
> . . . . the man,
> Who needlessly sets foot upon a worm."

By *worm*, we wonder if he included the grub-worm. Alas! little did that amiable man think of the mischief that would ensue from this sensibility and tenderness towards insects. He thought that when nature created them, and designed them an "abode," that it was a species of cruelty to hunt or harm them, when not actually crawling "in th' alcove, the chamber, or refectory." But the harm that the few do, who so inadvertently approach our dwellings, is insignificant when compared to the ravages of every kind of insect, excepting the bee, when in the abode that nature assigned it. This very worm, from which they bid us turn aside when we meet it in our path, after destroying the roots of our pasture and our corn, becomes a winged insect, and continues its mischief to the destruction of our finest fruits.

We really are in a sad plight between our sensibilities and our sense of justice to ourselves. We say that insects have so multiplied, that we can neither raise grain for our cattle, nor fruit for ourselves. "Keep the birds near you," say the philosophers, "quit the cruel practice of shooting the harmless songsters of the grove, and you will not only be rewarded by seeing that insects decrease,

but you will be charmed by their melody." But, then, we say in answer, that the birds do not discriminate; that they prefer bees to every other insect, and, therefore, the birds must die. And in reality, we must make war upon those birds, that show the greatest fondness for our little friends. Let us, at least, show our sense of the value of these, by keeping their enemies away, at any rate, from their very doors. Let us lessen the chance of their encountering them abroad, by planting the favourite food of the bees, as near the apiary as possible; and, also, lessen the chance of their being drowned, when driven by high winds, as they stoop to drink, by giving them running streams near to their hives.

We have scarcely observed any order in this discussion, setting down our thoughts just as they presented themselves. Had we written a regular work on this subject, we would in the proper place have spoken of the small bees, the aged, and those denominated *black*. As this essay is short, it will not be difficult for those who have a respect for our opinions, to cull out and methodize the different matter as it occurs, and we can then ramble on with our few remaining observations, to the close.

In the hive of a new swarm, during the months of July and August, there are fewer small bees, than in one that has been tenanted for four or five years. The bee, like all other insects, spins itself a covering before it becomes a fly. When it emerges with wings, from its cell, several older bees approach it, feed it with the contents of their stomachs, and then clean out the cell and deposit in it fresh honey. This is their constant practice; and the bee that is just born, as soon as it has been fed and has stretched its wings, flies off to a flower, and commences its labours. But, although the bees clean out the cell the moment a young bee is born, yet they either find no inconvenience from that part of the film, which the young bee leaves at the bottom of the cell, and which is of a silky nature, or they are unable to detach it. In consequence of this, the cell is not so deep, and as the same circumstances occur perpetually, brood alternating with honey, the cells become every year visibly smaller; and, consequently, those bees that are bred in these small cells, of which there is a great number, are never of the full size of those that have had more room. Even the queen eggs, which *we* say are often deposited in the cells of neuters, and have, afterwards, larger cells attached to the first, never produce so large a queen bee, as if the cell had been of proper dimensions at first. Thus we see that the contraction of the cell may diminish the *size* of a bee, even to the extinction of life, just as the contraction of a Chinese shoe reduces the foot even to uselessness; but in neither case will a single new organ be taken from, or added to the bee, or a single toe be taken from, or added to the foot, whether the cell, or shoe, be larger or smaller.

A young bee can readily be distinguished from an old one, by the grayish coloured down that covers it, and which it loses by the wear and tear of hard labour; and if the bee be not destroyed before the season is over, this down entirely disappears, and the ground-work

of the insect is seen, white or black. On a close examination, very few of these black, or aged bees, will be seen at the opening of the spring, as, not having the stamina of those that are younger, they perish from inability to encounter the vicissitudes of winter.

Our seasons are very variable. The scorching droughts of summer, deny to plants their accustomed moisture; no honey, therefore, can be made by the bees at such times, and they are compelled to eat of their winter food. They cluster about the hive, or, deprived of their accustomed labour, they are very restless, and often intrude into a neighbouring hive, apparently for the want of employment. In the summer of 1825, during the latter part of July, the heat was so distressing to the bees, the thermometer standing at 92° in the shade, that they seemed to have lost their usual instinct. A number of hives of the old-fashioned patterns, that stood on a bench, were well filled with bees. At two o'clock, for three days in succession, the whole swarm of each hive rushed out, and ran into the adjoining hive, where they remained for a few seconds, without apparent offence to the invaded bees, who, in their turn, flew madly out, and paid the same unceremonious visit to their neighbours. No quarrel ensued, not a bee was killed by these irruptive movements. They seemed maddened by the heat; and yet the queen was left in the hive, for with all our attention to the sallying parties, we did not see a single queen among them. The same frenzy did not occur in those hives that were suspended upon joists; thus proving that the bees did not suffer so much from heat in those suspended hives, as they did in the flat-bottomed ones, that rested on a bench.

Our winters are equally disastrous to the poor bees. Of late years, there have been so many mild days during the cold season, that a great deal of honey has been consumed. These alternations of torpor and animation, cause greater exhaustion and loss of physical powers, than would be occasioned by a continuance of uniform torpor. This we infer from the fact, that in Russia, where the winters are uniformly cold, bees do not perish; and in the West Indies, where there is perpetual verdure, they are never exhausted.

But, although a bee may remain torpid, to a certain extent, for six months in the year without injury, in those climates to which the insect has long been accustomed, yet it could not exist for the same space of time in lower latitudes, where such a period of continued cold rarely occurs. Nature has not constructed them for every emergency. She has done no more for them in this particular, than she has for man. They are compelled to get accustomed to a change of climate, by degrees; not by an alteration of the structure of their organs, for that can never occur under any circumstances, but by some change that takes place in the circulation of the fluids of the body, by which the system is accommodated to a higher or lower temperature. But we leave this part of the question to the naturalists learned in the science.

If we are correct in this our opinion, the suggestion of Dr. Anderson would not be available in our climate. If, according to his proposal, bees were to be kept all winter in an ice-house, more causes

than one would operate to the injury of their health, and, consequently, to the decrease of their number. The temperature of an ice-house, unless we are to suppose the hive to be buried in the ice itself, is much higher than that which is without the house. The torpor, therefore, would not be so complete, as to put a stop to the digestive process. The bees would be compelled to eat; and as their food is constantly in contact with the impure, stagnant air of the ice-house, it would soon become vitiated, and engender diseases.

We know of but two diseases to which the bees are subject, in this country, and they have, to our knowledge, never occurred at any other season, than the early part of the spring,—dysentery and dyspepsia. The latter arises from the indolent, inactive life that they are *compelled* to lead, in our variable winters. The rule holds good with the most diminutive, as well as the greatest, in animal life, that "if we eat and wish to preserve health, we must work."

During the last winter, (1828,) the bees suffered more, and lost more of their numbers, than has often been known before. There was scarcely a day that they did not sally out to search for employment and food; but not being properly stimulated, they seldom returned to the hive. We frequently saw them crawling on the ground, weak and spiritless; and those that did return, soon perished. On examining the hives, we observed that nearly all the honey was consumed; and many of the brood, that, in ordinary seasons, are not hatched until the first part of April, assumed the fly form at an earlier period, and died.

The cure for this disorder the bees take into their own hands. As soon as the flowers appear, they go to *work;* and then it is, that they resort to aperients and tonics, which they abstract from the floors of the piggeries.

The other disease proceeds from long confinement in bad air, and from unwholesome food, and is, invariably, fatal; nor can the bees avert it by any instinct of their own. We know of no cure for the dysentery, when the bee is seized with it. Those that have it badly, must die. We can restore those that are least affected, by frequently washing the hives, as far as we can reach, with weak lye, and by ventilating them and removing the dead bees.

Much has been said of the danger to be apprehended from placing an apiary too near our own dwelling. There is, indeed, no positive advantage in having it very near; but as the person usually engaged in hiving the bees, is occupied with farming affairs, and is not always present when the bees swarm, it is proper that the apiary should be within sight of the family. A bee, certainly, has frequently attacked a horse, and we have once or twice heard of one being stung to death. Considering the great number of hives of bees, it is really wonderful, that more accidents of this kind have not occurred. But they are exceedingly rare; and when we know how many hundred horses annually die from the disease called *the botts*, which proceeds from the maggots of the egg, laid by the *horse-bee* on the hair of the animal, the very few that suffer from the sting of the honey-bee, do not deserve to be taken into consideration.

In every point of view, therefore, it appears that bees should be cultivated. The wax that is consumed in this country, in various ways, is enormous, and most of it is imported. If we may credit Huish, Great Britain imports from Germany and Italy, upwards of eighty thousand pounds sterling worth of wax annually. We are unable to say, with any precision, to what amount it is imported by us; but judging from the quantity that each family uses in a year, and the amount employed in various arts, it must be worthy of notice.

It is really disgraceful to such a country as ours, to import wax or honey. We ought, ourselves, to export tons of it every year; and we trust that, in the course of a few years, this improvement will take place. Massachusetts and Connecticut are well situated, and abundantly supplied with proper food for bees; and their climate, being less variable, is better adapted to their nature. We spoke of hills of twenty or thirty feet in height; this only applies to the site of an apiary near a dwelling. The dwelling itself may be on a hill. We have heard of convents situated on mountains, that have been well stocked with hives. In short, nothing is wanting but good pasture, good hives, cleanliness, and attention, to insure a rich reward to those who engage in the pursuit.

Children are, naturally, very fond of watching the proceedings of bees, and they would soon learn to take care of them, if they were not taught to fear them. All danger can be guarded against, by making them wear woollen gloves that are long enough to draw over their sleeves at the wrist, and a wire cap to cover their head. They could thus be trained to manage bees; and training is quite as necessary to the full comprehension of the occupation, as it is in the trade of a carpenter or shoemaker.

It would be unjust not to refer again to Mr. Butler's little book, after making it the occasion of expressing our own thoughts. We shall rejoice if our slender notice of his work should encourage him to put forth a new edition; and we shall now take leave of the subject, although it be almost inexhaustible, by an anecdote, that we have reserved for the conclusion, that it may make the deeper impression.

A good old French bishop, in paying his annual visit to his clergy, was very much afflicted by the representations they made of their extreme poverty, and which the appearance of their houses and families corroborated. Whilst he was deploring the state of things which had reduced them to this sad condition, he arrived at the house of a curate, who, living amongst a poorer set of parishioners than any he had yet visited, would, he feared, be in a still more woful plight than the others. Contrary, however, to his expectations, he found appearances very much improved. Every thing about the house wore the aspect of comfort and plenty. The good bishop was amazed. "How is this, my friend?" said he; "you are the first man that I have met with a cheerful face and a plentiful board. Have you any income independent of your cure?" "Yes, sir," said the clergyman, "I have; my family would starve on the pittance I receive from the poor people that I instruct. Come with me into

the garden, and I will show you the *stock* that yields me an excellent interest." On going to the garden, he showed the bishop a large range of bee-hives. "There is the bank from which I draw an annual dividend. It never stops payment." Ever after that memorable visit, when any of his clergy complained to the bishop of poverty, he would say to them, "keep bees, keep bees;" and we shall bid our readers adieu with the same advice.

On the Strength of Materials.

[From Brunton's Compendium of Mechanics.]

(Concluded from p. 49.)

STRENGTH OF THE JOURNALS OF SHAFTS.

Lateral Strength.

The Rules in problem 5, of the last article, can be here applied. Mr. Robertson Buchanan, in his Essay on the Strength of Shafts, uses the following rule, which is simple enough, and easy to be remembered; but the above-mentioned rules, are the most correct, and ought to be used on all occasions.

Mr. Buchanan's rule is,—"The cube root of the weight in cwts. is nearly equal to the diameter of the journal."—"*Nearly equal*, —being prudent to make the journal a little more, than less, and to make a due allowance for wearing."

Example.

What is the diameter of the journal of a water wheel shaft, 13 feet long, the weight of the wheel being 15 tons?

By Mr. B.'s rule. $\sqrt[3]{15 \times 20} = 6.7$ or 7 inches diameter.

By Mr. Tredgold's rule.

Weight in the middle. $\left\{ \dfrac{33600 \times 13}{500} = 873 \quad \sqrt[3]{873} = 9\frac{1}{2} \right.$ inches diameter.

Weight equally distributed. $\left\{ 33600 \times 13 = 436800 \quad \dfrac{\sqrt[3]{436800}}{10} = 7.65 \right.$ inches.

To Resist Torsion or Twisting.

It is obvious that the strength of revolving shafts are directly as the cubes of their diameters and revolutions; and inversely, as the resistance they have to overcome.

Mr. Robertson Buchanan, in his Essay on the Strength of Shafts, gives the following data, deduced from several experiments, viz. that the fly wheel shaft of a 50 horse power engine, at 50 revolutions per minute, requires to be $7\frac{1}{2}$ inches diameter, and, therefore, the cube of this diameter, which is $= 421.875$, serves as a multiplier to all other shafts in the same proportion; and taking this as a standard, he gives the following multipliers, viz.

For the shaft of a steam engine, water wheel, or any shaft connected with a first power, - - - - - -	400
For shafts in inside of mills, to drive smaller machinery, or connected with the shafts above, - - - - -	200
For the small shafts of a mill or machinery, - - -	100

From the foregoing, the following rule is derived, viz.

The number of horses' power a shaft is equal to, is directly as the cube of the diameter and number of revolutions; and, inversely, as the above multipliers.

Note. Shafts here, are understood as the journals of shafts, the bodies of shafts being, generally, made square.

Example 1.

When the fly wheel shaft of a 45 horse power steam engine, makes 90 revolutions per minute, what is the diameter of the journal?

$$\frac{45 \times 400}{90} = 200 \qquad \sqrt[3]{200} = 5\tfrac{8}{10} \text{ inches diameter.}$$

Example 2.

The velocity of a shaft is 80 revolutions per minute, and its diameter is 3 inches: what is its power?

$$\frac{3^3 \times 80}{400} = 5.4 \text{ horse power.}$$

Example 3.

What will be the diameter of the shaft in the first example, when used as a shaft of the second multiplier?*

$$\frac{5.8}{1.25} = 4.64, \text{ or } \sqrt[3]{\frac{45 \times 200}{90}} = 4\tfrac{6}{10} \text{ inches diameter.}$$

The following is a table of the diameters of shafts, being the first movers, or having 400 for their multipliers.

* The diameters of the second movers will be found by dividing the numbers in the table by 1.25, and the diameters of the third movers, by dividing the numbers by 1.56.

TABLE.

DIAMETERS OF THE JOURNALS OF FIRST MOVERS.

Horses' power.	REVOLUTIONS.									
	10	15	20	25	30	35	40	45	50	55
4	5.5	4.8	4.5	4.	3.7	3.8	3.5	3.3	3.2	3.1
5	5.9	5.1	4.7	4.4	4.1	3.9	3.7	3.6	3.5	3.3
6	6.3	5.5	5.	4.6	4.4	4.1	4.	3.8	3.7	3.6
7	6.6	5.8	5.2	4.9	4.6	4.4	4.2	4.	3.9	3.7
8	6.9	6.	5.5	5.1	4.8	4.6	4.4	4.2	4.1	4.
9	7.2	6.3	5.7	5.5	5.	4.8	4.5	4.4	4.2	4.1
10	7.4	6.6	5.9	5.6	5.2	4.9	4.7	4.6	4.4	4.2
12	7.9	6.9	6.3	5.8	5.6	5.4	5.2	5.	4.8	4.6
14	8.3	7.2	6.7	6.2	5.9	5.6	5.4	5.2	5.	4.7
16	8.7	7.6	7.1	6.6	6.1	5.8	5.6	5.4	5.2	5.
18	9.	7.9	7.5	7.	6.6	6.2	5.8	5.6	5.4	5.2
20	9.3	8.1	7.4	7.2	6.6	6.4	5.9	5.7	5.6	5.4
25	10.	8.5	8.	7.4	7.1	6.8	6.3	6.	5.9	5.6
30	10.7	9.3	8.4	7.9	7.4	7.1	6.9	6.7	6.5	6.3
35	11.4	9.8	8.9	8.4	7.9	7.4	7.1	6.9	6.6	6.5
40	11.7	10.5	9.3	8.8	8.3	7.8	7.4	7.2	6.9	6.7
45	12.	10.6	9.7	9.2	8.7	8.1	7.6	7.4	7.	6.8
50	12.6	11.	10.	9.3	9.	8.5	8.	7.8	7.4	7.3
55	13.4	11.4	10.4	9.8	9.1	8.8	8.4	8.	7.5	7.4
60	13.6	12.	10.8	10.	9.3	9.	8.6	8.2	7.7	7.6

INCHES DIAMETER.

TABLE CONTINUED.

Horses' power.	REVOLUTIONS.									
	60	65	70	75	80	85	90	95	100	105
4	3.	2.9	2.9	2.8	2.7	2.7	2.6	2.6	2.6	2.5
5	3.3	3.2	3.1	3.	3.	2.9	2.9	2.8	2.8	2.7
6	3.5	3.5	3.4	3.3	3.2	3.2	3.	3.	2.9	2.9
7	3.6	3.6	3.5	3.4	3.4	3.3	3.3	3.2	3.1	3.1
8	3.9	3.8	3.7	3.6	3.5	3.5	3.4	3.4	3.3	3.2
9	4.	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.4	3.3
10	4.1	4.	3.9	3.8	3.7	3.7	3.6	3.6	3.5	3.4
12	4.4	4.3	4.2	4.1	4.	3.9	3.8	3.8	3.7	3.6
14	4.5	4.4	4.4	4.3	4.2	4.1	4.	4.	3.9	3.8
16	4.8	4.7	4.6	4.5	4.4	4.4	4.3	4.2	4.1	4.
18	5.	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.2
20	5.2	5.1	5.	4.8	4.6	4.6	4.5	4.5	4.4	4.4
25	5.5	5.4	5.3	5.2	5.1	4.9	4.8	4.7	4.6	4.6
30	5.9	5.8	5.7	5.6	5.5	5.3	5.2	5.1	5.	4.9
35	6.3	6.1	5.9	5.7	5.6	5.5	5.4	5.3	5.2	5.2
40	6.6	6.4	6.2	6.	5.9	5.8	5.7	5.6	5.6	5.5
45	6.7	6.5	6.4	6.2	6.1	6.	5.9	5.8	5.7	5.6
50	7.2	6.9	6.8	6.6	6.5	6.4	6.2	6.	5.9	5.8
55	7.3	7.2	7.	6.7	6.6	6.5	6.3	6.2	6.1	6.
60	7.4	7.3	7.2	6.9	6.8	6.8	6.7	6.6	6.4	6.2
	INCHES DIAMETER.									

It is a well known fact, that a cast-iron rod will sustain more torsional pressure. than a malleable iron rod of the same dimensions. —That is, a malleable iron rod will be twisted by a less weight than what is required to wrench a cast-iron rod of the same dimensions.

When the strength of malleable iron is less than that of cast-iron to resist torsion, it is stronger than cast-iron to resist lateral pressure, and that strength is in proportion as 9 is to 14.

From the foregoing, it is easy for the millwright to make the shafts of the iron best suited to overcome the resistance to which they will be subject, and the proportion of the diameters of their journals, according to the iron of which they are made:—for example; what will be the diameter of a malleable iron journal, to sustain an equal weight with a cast-iron journal of 7 inches diameter?

$$7^3 = 343.$$

$14 : 343 : : 9 : 220\frac{1}{2}$ now $\sqrt{220.5} = 6.04$ inches diameter.

STRENGTH OF WHEELS.

The arms of wheels are as levers fixed at one end, and loaded at the other, and, consequently, the greatest strain is upon the end of the arm next the axle; for that reason all arms of wheels should be strongest at that part, and tapering towards the rim.

The rule for the breadth and thickness of arms, according to their length and number in the wheel, is as follows: (*See Tredgold's Essay, page* 114.) Multiply the power or weight acting at the end of the arm by the cube of its length; the product of which, divided by 2656 times the number of arms multiplied by the deflection, will give the breadth and cube of the depth.

Example.

Suppose the force acting at the circumference of a spur wheel to be 1600 lbs. the radius of wheel 6 feet, and number of arms 8, and let the deflection not exceed $\frac{1}{10}$ of an inch.

$$\frac{1600 \times 6^3}{2656 \times 8 \times .1} = 163 = \text{breadth and cube of the depth.}$$

Let the breadth be 2.5 inches, therefore $\frac{163}{2.5} = 65.2$, which is equal to the cube of the depth: now the cube root of 65.2 is nearly 4.03 inches; this, consequently, is the depth, or dimension, of each arm in the direction of the force.

Note. When the depth at the rim is intended to be half that of the axes, use 1640 as a divisor, instead of 2656.

The teeth are as beams, or cantilevers, fixed at one end and loaded at the other, the rule applying direct to them, (*See Tredgold's Essay, Art.* 121,) where the length of the beam is the length of the teeth, and the depth the thickness of the teeth. For the better explanation of the rule, the following example is given.

Example.

The greatest power acting at the pitch line of the wheel, is 6000 lbs. and the thickness of the teeth $1\frac{1}{2}$ inch, the length of the teeth being 0.25 feet; it is required to determine the breadth of the teeth.

$$\frac{6000 \times 0.25.}{212 \times \overline{1.5}^2} = \frac{1500}{477} = 3.2 \text{ inches the breadth required.}$$

In order that the teeth may be capable of offering a sufficient re-

sistance after being worn by friction, the breadth thus found should be doubled; therefore, in the above example, the breadth should be 6.4, or say, 6½ inches.

Mr. Carmichael* gives the following data, gleaned from experiments, which is, therefore, valuable, and of much use to the practical mechanic.

Rule. Multiply the breadth of the teeth by the square of the thickness, and divide the product by the length; the quotient will be the proportional strength in horses' power, with a velocity of 2.27 feet per second.

Example.

What is the power of a wheel, the teeth of which are 6 inches broad, 1.5 inch thick, and 1.8 inch long, and revolving at the velocity of 3 feet per second?

$$\frac{1.5^2 \times 6}{1.8} = \frac{13.5}{1.8} = 7.5 \text{ strength at 2.27 feet per second.}$$

then $2.27 : 7.5 :: 3 = \frac{7.5 \times 3}{2.27} = 9.91$ horse power.

Rule. The pitch is found by multiplying the thickness by 2.1, and the length is found by multiplying the thickness by 1.2.

Example.

The thickness being 2 inches, what is the pitch and length?

$$2 \times 2.1 = 4.2 \text{ Pitch.}$$

$$2 \times 1.2 \times 2.4 \text{ Length.}$$

Note. The breadth of the teeth, as commonly executed by the best masters, seems to be from about twice to thrice the pitch.

TABLE.

Pitch in Inches.	Thickness in Inches.	Breadth in Inches.	Length in Inches.	Horses' Power at 2.27 feet per Sec.	H. P. at 3 feet per. Sec.	H. P. at 6 feet per Sec.	H. P. at 11 feet per Sec.
4.2	2.	8.	2.40	13.33	17.61	35.23	64.6
3.99	1.9	7.6	2.28	13.03	15.90	31.80	58.30
3.78	1.8	7.2	2.16	10.80	14.27	28.54	52.32
3.57	1.7	6.8	2.04	9.63	12.72	25.54	46.68
3.36	1.6	6.4	1.92	8.53	11.27	22.54	41.32
3.15	1.5	6.	1.80	7.50	9.91	19.82	36.33
2.94	1.4	5.6	1.68	6.53	8.63	17.26	31.64
2.73	1.3	5.2	1.56	5.63	7.44	14.88	27.28
2.52	1.2	4.8	1.44	4.80	6.34	12.68	23.24
2.31	1·1	4.4	1.32	4.03	5.32	10.64	19.54
2.10	1.	4.	1.20	3.33	4.40	8.81	16.15
1.89	.9	3.6	1.08	2.70	3.57	7.14	13.09
1.68	.8	3.2	.96	2.13	2.81	5.62	10.33
1.47	.7	2.8	.84	1.63	2.15	4.30	7.88
1.26	.6	2.4	.72	1.20	1.59	3.18	5.83
1.05	.5	2.	.60	.83	1.10	2.20	4.03

* See Robertson Buchanan on the Teeth of Wheels.

VELOCITY OF WHEELS.

Wheels are for conveying motion to the different parts of a machine, at the same, or at a greater or less velocity, as may be required.—When two wheels are in motion, their teeth act on one another alternately, and, consequently, if one of these wheels has 40 teeth, and the other 20 teeth, the one with twenty will turn twice upon its axis, for one revolution of the wheel with 40 teeth.—From this the rule is taken, which is,—as the velocity required is to the number of teeth in the driver, so is the velocity of the driver to the number of teeth in the driven.

Note. To find the proportion that the velocities of the wheels in a train should bear to one another, subtract the less velocity from the greater, and divide the remainder by the number of one less than the wheels in the train; the quotient will be the number rising in arithmetical progression, from the least to the greatest velocity of the train of wheels.

Example 1.

What is the number of teeth in each of three wheels to produce 17 revolutions per minute, the driver having 107 teeth, and making 3 revolutions per minute?

$$\frac{17 - 3 = 14}{3 - 1 = 2} = 7,$$ therefore, 3 10 17 are the velocities of three wheels.

By the rule. $$\begin{cases} 10 : 107 :: 3 : 32 = \dfrac{107 \times 3}{10} = 32 \text{ teeth.} \\ 17 : 32 :: 10 : 19 = \dfrac{32 \times 10}{17} = 19 \text{ teeth.} \end{cases}$$

Example 2.

What is the number of teeth in each of 7 wheels, to produce 1 revolution per minute, the driver having 25 teeth, and making 56 revolutions per minute?

$$\frac{56 - 1 = 55}{7 - 1 = 6} = 9,$$ therefore, 56 46 37 28 19 10 1, are the progressional velocities.

46 :	25 : :	56 :	30	Teeth.
37 :	30 : :	46 :	37	——
28 :	37 : :	37 :	49	——
19 :	49 : :	28 :	72	——
10 :	72 : :	19 :	137	——
1 :	137 : :	10 :	1370	——

It will be observed that the last wheel, in the foregoing example, is of a size too great for application; to obviate this difficulty, which frequently arises in this kind of training, wheels and pinions are used, which give a great command of velocity.—Suppose the velocities of last example, and the train only of 2 wheels and 2 pinions.

$$\frac{56 - 1 = 55}{4 - 1 = 3} = 18,$$ therefore, 56 19 1, are the progressional velocities.

19 : 25 : : 56 : 74 = teeth in the wheel driven by the first driver, and 1 : 10 : : 19 : 190 = teeth, in the second driven wheel, 10 teeth being in the driving pinion.

25 drivers 74 driven.
10 —— 190 ——

The following is a table of the radii of wheels, from ten to three hundred teeth, the pitch being 2 inches.

The radius for any other pitch may be found by the following analogy:—as two inches is to the radius in the table, so is the new pitch to the new radius.

TABLE.

No. of Teeth.	Radius in Inches.	No. of Teeth.	Radius in Inches.	No. of Teeth.	Radius in Inches.	No. of Teeth.	Radius in Inches.
10	3.236	46	14.654	82	26.108	118	37.565
11	3.549	47	14.972	83	26.426	119	37.883
12	3.864	48	15.290	84	26.741	120	38.202
13	4.179	49	15.608	85	27.063	121	38.520
14	4.494	50	15.926	86	27.381	122	38.838
15	4.810	51	16.244	87	27.699	123	39.156
16	5.126	52	16.562	88	28.017	124	39.475
17	5.442	53	16.880	89	28.336	125	39.793
18	5.759	54	17.198	90	28.654	126	40.111
19	6.076	55	17.517	91	28.972	127	40.429
20	6.392	56	17.835	92	29.290	128	40.748
21	6.710	57	18.153	93	29.608	129	41.066
22	7.027	58	18.471	94	29.927	130	41.384
23	7.344	59	18.789	95	30.245	131	41.703
24	7.661	60	19.107	96	30.563	132	42.021
25	7.979	61	19.425	97	30.881	133	42.339
26	8.296	62	19.744	98	31.200	134	42.657
27	8.614	63	20.062	99	31.518	135	42.976
28	8.931	64	20.380	100	31.836	136	43.294
29	9.249	65	20.698	101	32.155	137	43.612
30	9.567	66	21.016	102	32.473	138	43.931
31	9.885	67	21.335	103	32.791	139	44.249
32	10.202	68	21.653	104	33.109	140	44.567
33	10.520	69	21.971	105	33.427	141	44.885
34	10.838	70	22.289	106	33.746	142	45.204
35	11.156	71	22.607	107	34.064	143	45.522
36	11.474	72	22.926	108	34.382	144	45.840
37	11.792	73	23.244	109	34.700	145	46.158
38	12.110	74	23.562	110	35.018	146	46.477
39	12.428	75	23.880	111	35.337	147	46.795
40	12.746	76	24.198	112	35.655	148	47.113
41	13.064	77	24.517	113	35.974	149	47.432
42	13.382	78	24.835	114	36.292	150	47.750
43	13.700	79	25.153	115	36.611	151	48.068
44	14.018	80	25.471	116	36.929	152	48.387
45	14.336	81	25.790	117	37.247	153	48.705

TABLE CONTINUED.

No. of Teeth.	Radius in Inches.	No. of Teeth.	Radius in Inches.	No. of Teeth.	Radius in Inches.	No. of Teeth.	Radius in Inches.
154	49.023	191	60.800	228	72.577	265	84.354
155	49.341	192	61.118	229	72.895	266	84.673
156	49.660	193	61.436	230	73.214	267	84.991
157	49.978	194	61.755	231	73.532	268	85.309
158	50.296	195	62.073	232	73.850	269	85.627
159	50.615	196	62.392	233	74.168	270	85.946
160	50.933	197	62.710	234	74.487	271	86.265
161	51.251	198	63.028	235	75.805	272	86.582
162	51.569	199	63.346	236	75.123	273	86.900
163	51.888	200	63.665	237	75.441	274	87.219
164	52.206	201	63.983	238	75.760	275	87.537
165	52.524	202	64.301	239	76.078	276	87.855
166	52.843	203	64.620	240	76.397	277	88.174
167	53.161	204	64.938	241	76.715	278	88.462
168	53.479	205	65.256	242	77.033	279	88.810
169	53.798	206	65.574	243	77.351	280	89.129
170	54.116	207	65.893	244	77.670	281	89.447
171	54.434	208	66.211	245	77.988	282	89.765
172	54.752	209	66.529	246	78.306	283	90.084
173	55.078	210	66.848	247	78.625	284	90.402
174	55.389	211	67.166	248	78.943	285	90.720
175	55.707	212	67.484	249	79.261	286	91.038
176	55.026	213	67.803	250	79.580	287	91.357
177	55.344	214	68.121	251	79.898	288	91.675
178	56.662	215	68.439	252	80.216	289	91.993
179	56.980	216	68.757	253	80.534	290	92.312
180	57.299	217	69.075	254	80.853	291	92.630
181	57.617	218	69.394	255	81.171	292	92.948
182	57.935	219	69.712	256	81.489	293	93.267
183	58.253	220	70.031	257	81.808	294	93.585
184	58.572	221	70.349	258	82.126	295	93.903
185	58.890	222	70.667	259	82.444	296	94.222
186	59.209	223	70.985	260	82.763	297	94.540
187	59.527	224	71.304	261	83.081	298	94.858
188	59.845	225	71.622	262	83.399	299	95.177
189	60.163	226	71.941	263	83.717	300	95.495
190	60.482	227	72.258	264	84.038		

On some kinds of Fulminating Powder inflammable by Percussion, and their use in Fire-arms. By P. W. Schmidt, Lieutenant in the Prussian service.*

A powder, inflammable by percussion, has been used for some years past, especially in fowling-pieces. The following formulæ

* From Schweigger's Journal, Band xi. p. 66.

have been given for the preparation of this powder, the principal ingredient of which is chlorate of potash.

1. 100 parts of chlorate (oxy-muriate) of potash, 12 parts of sulphur, and 10 parts of charcoal are intimately mixed. The grains are produced by forcing the soft paste through a sieve.

2. 100 parts of chlorate of potash, 42 parts of saltpetre, 36 parts of sulphur, and 14 parts of lycopodium.

These are the usual ingredients that have hitherto been mixed with the chlorate of potash for the purpose of making priming powder. The guns, however, with which this powder is used, are very various in their construction. In some it primes itself by means of the mechanism of the lock, passing, on being cocked, into a small conical recess, which communicates with the touch-hole; in others, it is put in previous to every shot. In the former kind of guns a quantity of powder sufficient for a certain number of shots is kept in a recess attached to the lock, called a magazine; and the locks (which were invented in England by Mr. Forsyth) are called magazine locks.

In some guns the stroke of the cock, which is in the shape of a hammer, falls immediately on the fulminating powder strewed in the above recess. In order to protect the powder from wet, small balls of it were covered over with wax, and placed sometimes in the conical recess, and at others fixed to the cock itself. In both instances the ball was kindled in the recess just mentioned, by means of the percussion.

Besides these, other contrivances have been used for the purpose of igniting this kind of powder; yet they have all their defects, and offer so many difficulties in practice as to have prevented their general introduction.

Latterly, they have contrived in Germany to fix the powder in a small case of very thin copper foil, for the purpose of keeping it dry; and for that purpose a cylinder is screwed into the body of the gun instead of the touch-hole, and rests, for the sake of greater support, on the plate of the lock, instead of resting on the pan. The inner space of the cylinder is filled, in loading, with the same powder as that of the charge. The igniting-cap, at the bottom of which is the detonating powder, is, previous to firing, turned up on the cylinder. In this cylinder is a small round aperture, leading to the inner space of the cylinder. On the trigger being pulled, the cock strikes the igniting-cap, and the fulminating powder is kindled by the blow, flows through the aperture, inflames the shot, and breaks the igniting-cap.

Mr. Wright seems to have taken great pains with the subject.* He recommends, for the igniting-caps, to use fulminating mercury, saying that sportsmen had justly complained of the powder made of chlorate of potash, since it soon produces the oxidation of the barrel and touch-hole, and the charcoal which remains after the firing, rendering them unfit for use. The advantages of his new powder he enumerates as follows: it does not make the gun rusty so soon as the

* Mr. Wright's paper will be found in Phil. Mag. vol. lxii. p. 203.

other; it produces neither dirt nor moisture; it is not so liable to explode as the other powder, and if it does explode, its effects are less destructive, inasmuch as its power does not extend so far.

The following is his mode of preparation:

"I place two drachms of quicksilver in a Florence flask, and pour six drachms (measure) of *pure* nitric acid on the mercury; this I place in a stand over a spirit lamp, and make it boil till the quicksilver is taken up by the acid; when nearly cool, I pour it on an ounce (measure) of alcohol in another flask: sometimes immediate effervescence ensues, with the extrication of nitrous æther; and often I have been obliged to place the mixture over the lamp, till a white fume begins to rise, when the effervescence follows. I suffer the process to continue (removing the lamp) till the fumes assume a reddish hue; when I pour water into the flask, and the powder is found precipitated to the bottom; I pour off and add fresh water, permitting the powder to subside each time before the water is poured off, so as to free the substance as much as possible from the acid, and then I pour it on a piece of filtering paper, and place the powder in an airy room to dry. It should be kept in a corked (not stoppered) bottle."

For the filling of the caps, he makes use of an ivory rod, which has a scoop at one end for the purpose of receiving the powder, and at the other is cut flat; with this he puts in as much fulminating mercury as will cover the bottom; he then dips the flat end into a strong tincture of benzoin, and rubs this substance gently about the case; by which means the powder is set fast and covered as with a varnish.

Professor Schweigger, speaking of these kinds of experiments in his chemical lectures, noticed the difficulty of kindling gunpowder by the mere admixture of such substances, as has been shown in a criminal investigation that took place at Munich a few years ago. A box filled with gunpowder was sent to an individual; enclosed were fulminating papers, which were to inflame on the box being opened. Fortunately, however, the murderous design was frustrated; for although the papers exploded, they did not kindle the powder. The assassin was discovered and punished. M. Gehlen, who had been examined at the trial, was led by the circumstance to make several experiments for the purpose of kindling gunpowder by means of Brugnatelli's fulminating silver, but they all failed.

It seems that in England, too, difficulties had been found in igniting gunpowder with fulminating mercury; for Mr. Wright observes, "if any one doubts the practicability of firing gunpowder by means of fulminating mercury, by procuring a percussion-gun, he may try the experiment and be fully satisfied."

Professor Schweigger having, therefore, requested me to try some experiments on this subject, especially with fulminating silver, I made them in the chemical laboratory of our university, and the following were the results.

I. Fulminating silver was prepared in the usual way; five drachms of fuming nitric acid, and five of alcohol were poured over one drachm of fused nitrate of silver. When the effervescence and solution were

complete, water was added. The precipitate of fulminating silver was filtered off, and all the remaining acidity washed from it with water. The liquid which had passed through the filter gave with muriatic acid a copious precipitate of chloride of silver. The fulminating silver, which was of a whitish tint, was now subjected to the following experiments:

1. When damp, it ignited very rarely, and only by a strong blow. When dry, it explodes easily, and with a much slighter blow.

2. When touched with sulphuric acid, it exploded equally strongly, whether damp or dry.

3. Damp or dry, it exploded in the fire.

4. The substance which remained after the ignition, was of a bluish brilliant hue and a disagreeable metallic taste. I could gather but little, which, dissolved in water, produced a faint red tint on litmus paper.

5. I failed in several attempts to ignite gunpowder with the fulminating silver. I therefore put quantities of the size of a small pin's head, into some copper boxes, fastening it in some with tincture of benzoin, in others with a solution of gum arabic in water; and others I tried to press on the bottom without any other aid. I applied them to guns prepared for the use of igniting-caps, and thus kindled the gunpowder with incredible swiftness. The series of experiments thus made in the presence of Professor Schweigger, leaves no doubt that fulminating silver will easily ignite gunpowder, if it be secured against a rapid dispersion on exploding.

II. The fulminating mercury was prepared in the manner prescribed by Mr. Wright. But I must observe that the experiment only succeeded by the application of fuming nitric acid. The fulminating mercury, when obtained, was washed till every particle of acidity had disappeared from it. It was then submitted to the following experiments:

1. When dry, it exploded like fulminating silver, and with a much slighter blow than required for the powder made of chlorate of potash. Thus it would appear as if the fulminating quicksilver had not in this respect the advantage over the igniting powder made with the salt just named.

2. When perfectly dry only, it could be ignited with sulphuric acid.

3. In the fire it exploded, both wet and dry.

4. The substance remaining after the explosion, had a bluish brilliant tint and a bitter, acid, metallic taste. With a small quantity dissolved in water, litmus paper was slightly reddened. I made no further investigation, inasmuch as the examination of the acids of fulminating metals, before and after the explosion, was not my object; especially since Dr. Liebig has lately published a series of very interesting experiments, the repetition of which would require very extensive labour.* Liebig calls those acids fulminic acids, which

* Vide *Ann. de Chim. et de Phys.* part xxiv. p. 294, or the translation in Gilbert's *Annalen der Phys.* part. lxxv. p. 393—422. Mr. Liebig found that Brug-

being the property of all metals, he distinguishes into silver and mercury fulminic acids, &c.

The great advantages, however, of the fulminating quicksilver for igniting powder, so extolled by Mr. Wright, I did not find confirmed, although I proceeded to fill copper caps, as I had done with the detonating silver, which all ignited the charge.

III. I also submitted to experiment the first-named mixture, principally consisting of chlorate of potash; and found

1. That it exploded only by a hard blow. Its effects were much less than those of the detonating silver, or quicksilver. Mr. Wright, indeed, says the contrary of the latter; it seems, therefore, that I used a better kind of fulminating mercury; but for that very reason I must give the chlorate of potash the preference for practical use.

2. In the fire it puffed away like gunpowder.

3. The substance remaining after the explosion is blackish and dusty, and contains less of acidity than that left by the quicksilver. Thus, and indeed from all my experiments, it is evident that it oxidizes the iron less than the fulminating mercury. Moisture is also left by the latter; and the charcoal left by the mixture of chlorate of potash, after kindling a copper cap filled with it, is very unimportant:—therefore this mixture is preferable as an igniting powder. This is also the reason why the manufacturers no longer use the fulminating quicksilver. I know one who makes and fills, weekly, several thousands of copper caps, for which he uses the chlorate mixture, the preparation of which is both less expensive and less dangerous than that of the fulminating quicksilver. There is another circumstance attending this mixture; in filling the caps, it

natelli's detonating silver was dissolved in lime-water or solutions of the caustic alkalies, whereby 31,25 per cent of oxide of silver was deposited. They produce peculiar salts, called *fulminates*, which explode with great violence. These salts are dissolved by nitric acid, sulphuric acid, and acetic acid; the silver fulminic acid contained in them, and so difficult to be dissolved, is deposited; and by heating a solution of fulminate of lime to the boiling point, and adding a moderate quantity of nitric acid, is deposited, on cooling, at the bottom of the vessel, in the shape of long white crystals. This acid may be easily dissolved in boiling water; from which it crystallizes again in cooling, has a disgusting metallic taste, and reddens litmus paper: but it cannot subsist of itself without combination with a metal; and in the same manner as there are prussiates of iron, copper, silver and gold, so the fulminic acid combines with silver, quicksilver, copper, iron, zinc, &c. into proper fulminates, which again form different combinations with the bases *e. g.* potash, soda, barytes, strontian, lime, &c. Thus, for instance, silver-fulminate of potash consists of 35,03 parts of silver-fulminic acid and 14,92 of potash; silver-fulminate of soda, of 88,66 parts of silver-fulminic acid and 11,34 of alkali. When cooling, Berthollet's detonating silver forms granular shining white crystals. One part of this salt makes as violent a report as three parts of Howard's (Brugnatelli's) fulminating silver. With magnesia the silver-fulminic acid combines in two ways; one combination is a simple decrepitating, not detonating, insoluble powder, of a rosy tint; the other forms white capillary crystals, and explodes very loudly. The first combination was used for the analysis of fulminic acid in the dry way; in which the fulminating silver was evinced to consist of 32,22 of oxygen, 3,22 of hydrogen, 11,28 of azote, 9,68 of carbon, and 41 of silver.

will sometimes happen that the quantity put in is doubled, which I find is of no injurious consequence with this mixture; but might endanger the person firing with the fulminating mercury, as the cap will burst too violently.

With respect to the power of igniting the charge, the different kinds of powder which I have compared are equally effectual.

IV. I submitted the mixture of chlorate of potash mentioned above to the following experiments.

1. That part only ignited which was struck, without igniting that lying around it.

2. In the fire it burns away with noise.

3. I placed it in the usual way in copper caps, but could not ignite a charge with them. The cause of this may be explained by the construction of the locks, with reference to the properties of this detonating powder. That part of the cap situated just above the opening of the cylinder remains, as the blow cannot fall on it unignited, as shown by the experiment No. 1. But the communication of the ignited part with the charge, is prevented by the manner in which the cock strikes the cap. In guns in which such powder is used for igniting, it lies as above stated, in small balls in a conical aperture. Here it is nearly all ignited by the striking of the cock, and must of necessity flow inwards, every other way of escape being shut up.

In conclusion:—I have to add that the method of filling the caps recommended by Mr. Wright is not only laborious, but even dangerous. How are manufacturers to employ that method when they have to fill several thousands a week? I have made various trials, and the following process seems to me to be the best.

Pour some adhesive solution or tincture over the powder, and mix it into a stiff kind of liquid. Take with a brush or a stick a large drop of it, and apply it against the bottom of the cap.

This method is both quick and free from danger; whilst on filling with the dry detonating powder, the least careless touch may produce an explosion.

In order to prevent the corrosion of the cylinder, and its becoming useless by the formation of sulphuret of iron (an evil very common with iron touch-holes, and caused more by the action of the gun-powder than by that of the igniting substance,) the inside of the cylinder should be lined with a metal which will neither oxidate nor easily combine with the ingredients of the powder.—[*Philos. Mag.*

Manufacture of Sugar of Lead.

This salt is an object of considerable interest on account of the great use made of it in calico-printing, as well as in some other arts. In the calico-printing business, it is in reality one of the most useful preparations; or according to the French term, which many of the English writers wish to naturalize among us, mordant, or biter-in.

It is probable that in time it will be less used than at present; and that acetate of lime, which is a much cheaper salt, and which also decomposes alum, and changes its base into an acetate, will be preferred.

The French complain much that this change is likely to take place; because the manufacture of sugar of lead brings into use the inferior wines produced in some of their provinces, especially those which will not keep for any time: but as a greater consumption has taken place, and the pyroligneous acid, or vinegar of wood, presents greater advantages, these two products are become reciprocal advantages.

Formerly this acetate of lead was made from vinegar and blue lead: that is to say, common metallic lead: some manufacturers, however, used white lead for this purpose; but as this is usually mixed with more or less whiting, a portion of the acid was taken up by this calcareous earth; the acetate of lime thus produced, augmented the quantity of mother water, and was injurious to the crystallization.

The process formerly used was this; as the lead is not attacked by the acid while it retains its metallic form, cast lead was cut in pieces by chisels, for milled lead was considered as too close; these cuttings were put into pans, and a small quantity of vinegar was poured on them, but not sufficient to cover them. The part which was not sunk beneath the acid becomes oxidized in a short time; and as the cuttings were stirred several times a day, in order to change the surfaces exposed to the air or to the acid, the oxide was gradually dissolved in the vinegar. When the acid was saturated, the liquors in the several pots were poured into a tinned copper boiler, and boiled down one-third; the liquor was then filtered, and boiled down again, until on trial it appeared fit for crystallizing; it was then decanted and set by to crystallize; the first crop was large and white needle-like crystals; but the mother waters, by further evaporation, yielded coloured crystals.

This method has given place to another, which is far superior, and founded upon an exact knowledge of the nature and proportion of this salt.

It is well known that, according to the best analysis, the acetate of lead is composed in round numbers of 58 parts, in 100 oxide of lead, 26 of acid, and 16 of water; of course, the saturating power of the pyroligneous acid intended to be employed must be examined, in order to determine how much of it answers to 26 parts of the dry acid. When this acid is at 40 degrees of the acidemeter, it generally requires 68 lbs. of it to be poured on 58 lbs. of litharge. The solution takes place immediately, and is so quickly made, that a considerable heat is produced, which retains the sugar of lead in solution; but a little fire is usually given, and some water added, to keep up this solution until the liquor has become clean, and it is then poured into crystallizing pans.

The crystals, which usually weigh 75 lbs. are produced in about thirty-six hours; they are drained and carefully dried. The mother water, which contains about 25 lbs. of the sugar, by evaporation

yields great part of its contents; but the crystals are by no means so fine as the former. When the mother waters no longer yield crystals, they are mixed with salts of soda, when a carbonate of lead falls down, and acetate of soda remains in solution. The carbonate of lead may be used instead of litharge in future operations.

It will be found preferable at first to add the mother water to the acid and litharge, and thus near 100 lbs. of good sugar of lead will be obtained instead of 75 lbs. by the first crystallization; but this method cannot be continued for any time, as the liquor will become greasy, the crystallization will be hindered, and the sugar of lead becomes difficult to drain, so that it is then necessary to abstain from adding the mother water any longer to the solution, and to decompose it by salt of soda.

The acid ought to be pure, and particularly free from tar and sulphurous acid; the tar would discolour the sugar of lead, and the sulphurous acid produce an insoluble precipitate of sulphate of lead.

The boiling solution may be brought to various densities by adding more or less water; and as this difference produces some variety in regard to the crystals, the manufacturer, by a little observation, may suit the taste of his customers.

To obtain a very white sugar of lead, the metal or litharge should have no admixture of copper, as is usual in French lead, and German litharge. Its effects may, however, be obviated, by putting a few plates of lead into the boiler. But some manufacturers do not wish to separate the copper, because it gives the sugar of lead a slight bluish tinge, which pleases the eye of many of the buyers.

In this solution of the litharge in the acid there remains a very small residuum, which ought not to be thrown away; but when a quantity of it is collected, it may be treated as an ore of silver, as it is composed of that metal, united with oxide of copper, of lead, and some earthy substances.

It is a great advantage in this manner of forming sugar of lead, by means of strong pyroligneous acid, that it is not necessary to evaporate the solution for the purpose of crystallizing it, as was necessary when vinegar was used; for the solution is decomposed by being boiled, and part of the sugar of lead is changed into white lead, and of course, separates in form of powder.—[*Lond. Mech. Jour.*

Observations on the use of Cast Iron, &c. By D. TREADWELL, ESQ. Engineer.

[From the Boston Journal of Science.]

THE extensive use now made of cast iron, and that for purposes to which, but a few years ago, it was not thought of applying it, renders every investigation of its properties, and the modes of manufacturing it, important. This material, instead of being now confined in its use to a few culinary vessels and coarse implements, is not only used, to the exclusion of almost every thing else, for machinery, but houses, bridges, roads, and even vessels have been constructed of

it. Circumstances in England, no doubt, favour this extensive use much more than they do in this country. Coal and iron ore are there abundant, and wood is scarce and dear; while in New England we have no good mineral coal, and our forests of timber are yet extensive.

The use of cast iron for machines, has, however, become very general in this country. Without it the inventions of the present age could never have been carried into effect. A machine constituted of wood, subject to constant swelling and shrinking and warping with every change of the atmosphere, is always liable to derangement. Indeed it can be said to be hardly capable of preserving its identity; while castings undergo no change of figure, and their trifling change of magnitude, by the variation of temperature, is a matter of small moment.

A great deal yet remains to be done to improve the quality of castings in this country, but the demand for them, such as they are, is yet too great for us to expect the furnace owners and masters to give much attention to experiments for this purpose. The perpendicular mode of casting is very far from common at the furnaces in this vicinity, although it undoubtedly possesses advantages which should lead to its universal adoption. The strength of a bar, as has been ascertained by experiment, cast perpendicularly, being to that of one cast horizontally as 1218 is to 1166, while it is much less liable to air bubbles and imperfections of that kind, which render abortive the skill and calculations of the machinist. This superiority is not, as might be supposed from the terms employed, the effect of mere position, but of the pressure of the upright column; and if this is increased by a weight of extraneous metal, the casting is still more likely to be sound. This principle has lately been carried to the extent of compressing the fluid casting by mechanical means.

Iron has usually been divided into three kinds, the white, gray, and black; but as these pass into each other in every degree, it often happens that some castings do not bear the character of any one of the above kinds more than another. The white iron is hard and brittle, and it does not seem to be well understood to what this is to be attributed; while the black is soft and tender, and bears all the marks of containing too great a quantity of carbon. The gray iron, or gun metal, as it is sometimes called, is superior for almost every purpose; it is sufficiently soft to yield to the file, and is much stronger than either of the other kinds.

Cast iron, when used in machines or for buildings, should never be subjected to a weight or pressure which will produce a permanent alteration of its figure, or a *set*, as it is called by the workmen. As this can only take place from a change of the relation which the ultimate particles have to each other, small additions to a force which is sufficient to produce this change, will be sufficient to increase it until the relation is destroyed altogether. Although this may be taken as a principle, yet there is some limit in its application, depending on the shape and size of the bar, the kind of iron, and the direction of the force. It seems true of some bodies, particularly

those of a crystalline, or vitreous structure, that if strained, or if their particles are once separated beyond a certain point, the separation becomes complete. This point corresponds with that of their power to recover their former relations or distances; or the elastic power of the body. In these no permanent alteration of figure can be produced, for a fracture is the consequence of any force which destroys the elastic power. The hard kind of iron approaches this structure, and there is one considerable advantage in using it, which is, that it breaks immediately, if it break at all. Whereas, with the softer kinds, which will bear a permanent alteration of figure, the fracture may not take place until the force has continued to operate some time. But if a force be applied to this kind of iron, sufficient to produce such alteration, and be continued for a long time; or if the direction of it be constantly changing, as is often the case in machines, a fracture will at length be the result. Much, however, depends on the shape of the bar, and the direction of the force; where that direction is constant. As in a bar to which the force is applied transversely, if the iron be soft, the particles can undergo some change in distance beyond their elastic force, without losing their cohesive attraction. In this case those that are situated in the middle of the bar do not undergo any strain until the bar is somewhat curved; when an additional force is sustained by those particles as this curvature is produced, and before the particles situated outside are strained to the fracturing point. But in cases where the direction of the fracture must be at a right angle to the direction of the force, the principle, first stated, that the force applied should not be sufficient to produce a permanent change of figure, may be taken as true. This seems like going too much into the dark abyss of ultimate atoms; but as the facts above stated will be acknowledged, we hope to be excused for the manner in which we have connected them.

In forming castings to bear a transverse strain, it is common to increase the depth to equal several times the breadth; it having been generally understood that the strength is as the square of the depth multiplied into the breadth. But by the experiments of Mr. Rennie, (Phil. Trans. part 1st, 1818,) this rule was not found to hold in a bar of the depth of 4 inches, and the breadth of ¼ of an inch, although it held nearly up to this proportion; and that gentleman thinks it evident that the system of deepening has been carried nearly to its limits.

Experiments on the absolute strength of cast iron have been made by several individuals, philosophers as well as engineers. Those of Mr. Rennie, (Phil. Trans. 1818,) and some by Mr. Tredgold, an account of which has lately been published, are deserving of considerable attention. Mr. Rennie's experiments were made with an apparatus well calculated to give correct results. They show the power of iron to resist compression; its power to resist a twisting force; its tenacity when the force is applied to the bars in the direction of their axis, and when applied at right angles to that direction.

His experiments to find the power of iron in resisting compression. gave the following results. Cubes of ⅛ of an inch, taken from the

middle of a large block, were crushed with a weight of 1440 lb. And what may seem somewhat anomalous, in several trials on specimens having the same area as the preceding, but an increased height, the force required to crush them was increased. Cubes of $\frac{1}{4}$ of an inch were not crushed with a force less than 10,351 lb. on an average. As might be expected, the power of resistance is not as the area, but advances by a more rapid progression.

Mr. Rennie relates but two experiments on cast iron to ascertain its power to sustain weight, when directly suspended from the ends of bars. These were made with bars of $\frac{1}{4}$ of an inch area, and gave a mean of 1193 lb. equal to 19,088 lb. per inch. By the experiment of Muschenbroëk a bar of 1 inch area will sustain 63,286 lb. Mr. Rennie found that bars of $\frac{1}{4}$ of an inch square, having one end fixed in a vice, and a lever three feet in length, applied in a proper manner to twist them, were capable of sustaining about 9 lb. on the end of the lever. His experiments on the strength of bars to resist a force applied transversely, gave the following results. A bar 1 inch square, with supports 2 feet 8 inches apart, broke under a weight of 1086 lb. With the supports 1 foot 4 inches apart, a bar of the same size broke under 2320 lb. A bar 2 inches deep, $\frac{1}{2}$ an inch thick, 2 feet 8 inches long, broke with 2185 lb.; and, with the supports 1 foot 4 inches apart, it was again broken with 4508 lb. Triangular prisms, a cross section of which contained the same area as the foregoing pieces, were fractured with 1437 lb. when one of the angles was placed uppermost, and with 840 lb. when the angle was down, the supports in both cases being 2 feet 8 inches distant. Bars 3 inches deep and $\frac{1}{3}$ of an inch thick, and 4 inches deep and $\frac{1}{4}$ of an inch thick, required weights of 3588 lb. and 3979 lb. respectively to fracture them, when the supports were 2 feet 8 inches apart. Such are some of the experiments of Mr. Rennie. He also repeated the paradoxical experiment of Emerson, and found it true, that in triangular prisms, where the force is intended to act on one of the sides, the prism becomes stronger by having the portion containing its opposite angle cut away. That is, a part is stronger than the whole.

Mr. Tredgold's work, of which we have before spoken, is of a less experimental character than might be desired. He has, however, noticed some of the experiments of Mr. Rennie, and has given an account of others made by several different persons.

Mr. Tredgold has calculated two tables, the first showing the weight that bars of cast iron, of different magnitudes, will bear, without producing a deflexion of curvature of more than $\frac{1}{40}$ of an inch for each foot in length. This table was calculated from the equation $a\,W\,L^2 = B\,D^3$, in which W is the weight in pounds, L the length in feet, and B the breadth, and D the depth of the bar, in inches. The value of a was found by the following mode of investigation. Mr. Tredgold measured the deflexion of several loaded bars, and denoting it by d inches, he took the proportion d: $W :: \frac{L}{40} : \frac{W\,L}{40\,d}$ and putting this for W in the former equation it becomes $\frac{a\,W\,L^3}{40\,d} = B\,D^3$ and $a = \frac{40\,B\,D^3\,d}{W\,L^3}$ and substituting the numbers fur-

nished by an experiment we have $\frac{40 \times 1 \times 1 \times 1}{971 \times 27} = .00152$. He considers this too high a value, and as other experiments furnished it lower, he uses .001.*

The second table in this work shows, by inspection, the weight which cast iron beams or bars of 1 inch in breadth, and of different lengths and depths, will bear without destroying the elastic force. These loads are set down at about one-third of the load which would be required to produce immediate fracture, and the strength of equal lengths are founded on the rule of the square of the depth by the breadth.

Mr. Tredgold has taken it for a truth, "that while the force is within the elastic power of the material, bodies resist extension and compression with equal forces." As this seems not only to require proof, but to be in contradiction to many experiments, and as a great many of his calculations were founded on this as an axiom, we can have no confidence in the results of them.

We shall end this paper by a statement of the comparative power of a few different materials to sustain weights by suspension, according to Mr. Rennie's experiments.

				lbs.
1-4 inch cast iron bar, horizontal, sustained			- -	1166
1-4 inch cast iron bar, vertical,			- - - - -	1218
1-4 inch cast steel previously tilted			- - - -	8391
1-4 inch blister steel, reduced per hammer,			- -	8322
1-4 inch shear steel	do.	do.	- - -	7977
1-4 inch Swedish iron	do.	do.	- - -	4504
1-4 inch English iron	do.	do.	- - -	3492
1-4 inch hard gun metal			- - - - - -	2273
1-4 inch wrought copper			- - - - - -	2112
1-4 inch cast copper,			- - - - - -	1192
1-4 inch fine yellow brass,			- - - - - -	1123
1-4 inch cast tin,			- - - - - - - -	296
1-4 inch cast lead,			- - - - - - -	114

An Account of the Fire of St. Elmo. Extracted from a paper in the Edinburgh Philosophical Journal.

In the month of June, 1808, passing from the Island of Ivica to that of Majorca, on board a Spanish polacca ship, fitted as a cartel, and manned by about thirty ruffians, Genoese, Valencians, and Catalonians; a fine southerly gale, by seven in the evening, brought us within six or seven leagues of the anchorage in Palma Bay.

* Any of the results comprised in this table may be found by the practical man, by multiplying the cube of the depth of any bar in inches, by the breadth in inches, and dividing this product by the square of the length in feet. If this quotient be again multiplied by 1000, the product is equal to the number of pounds which the bar will sustain, without a deflexion of more than 1-40th of an inch to each foot, according to Mr. Tredgold.

About this time, the sea-breeze failing us astern, was shortly succeeded by light and baffling breezes off the land. No sooner had the setting sun withdrawn his golden beams from the tops of the lofty hills, which rise to the westward of the town, than a thick and impenetrable cloud, gathering upon the summit of Mount Galatzo, spread gradual darkness on the hills below, and extended at length a premature obscurity along the very surface of the shore. About nine, the ship becalmed, the darkness was intense, and rendered still more sensible by the yellow fire that gleamed upon the horizon to the south, and aggravated by the deep-toned thunder which rolled at intervals on the mountain, accompanied by the quick rapidity of that forked lightning, whose eccentric course, and dire effects, set all description at defiance. By half past nine, the hands were sent aloft to furl top-gallant-sails, and reef the top-sails, in preparation for the threatening storm. When retiring to rest, a sudden cry of St. Elmo and St. Ann, was heard from those aloft, and fore and aft the deck. An interpreter called lustily down the hatchway, that St. Elmo was on board, and desired me to come up. A few steps were sufficient, and, to my great surprise, I found the top-sail-yards deserted, the sails loose, and beating in the inconstant breeze, the awe-struck and religious mariners, bare-headed, on their knees, with hands uplifted, in voice and attitude of prayer, in earnest and muttering devotion to St. Elmo or St. Ann, according to the provincial nature of their speech.

On observing the appearance of the masts, the main-top-gallant-mast-head, from the truck, for three feet down, was perfectly enveloped in a cold blaze of pale phosphorous-looking light, completely embracing the circumference of the mast, and attended with a flitting or creeping motion, as exemplified experimentally, by the application of common phosphorus upon a board; and the fore and mizen top-gallant-mast-heads exhibited a similar appearance in a relative degree.

This curious illumination continued with undiminished intensity for the space of eight or ten minutes, when becoming, gradually, fainter and less extensive, it finally disappeared, after a duration of not less than half an hour.

The seamen, in the meantime, having finished their devotions, and observing the lights to remain stationary, returned promptly to the yards, and, under favour of this "Spirit of the Storm," now quickly performed that duty, which, on a critical conjuncture, had been abandoned, under the influence of their superstition and their fears. During the prevalence of the lights, as well as through the remaining hours of night, the wind continued, except in occasional puffs, light and variable; and the morning ushered in with a clear sky, a hot sun, and a light southerly breeze, which, in due time, brought us safe to the anchorage of Palma.

Conversing with the interpreter on the nature of this extraordinary atmospherical phenomenon, he expressed his implicit belief that it was provided by the immediate power of St. Elmo, the tutelar deity of "those who travel on the vasty deep," in regard to their interests

in a moment of sudden danger; and used every argument to persuade me, that the present safety of the ship was due to the very timeous and friendly interference of this aerial demigod; and that no accident could possibly have happened to the sails, while the seamen were at prayers, as long as the light glowed stationary on the mast. Had the light, he continued, descended gradually from the mast-head to the deck, and from thence to the kelson, as he had often seen it, the event would have prognosticated a gale of wind or other disaster, and, according to the depth of the descent, so would be the nature of the evil to come. In the present instance, the lights gradually disappeared, like the snuff of a candle, and the weather continued clear and fine for several subsequent days.

[*Boston Journal.*

An Account of the Passage of Water through an Aqueduct being totally obstructed by collections of Air; and on the Equilibrium of different fluids in bent tubes. By D. Treadwell.

A lead pipe, having a bore an inch and a half in diameter, was laid from a well in Roxbury, to the mills at the water works on the Boston mill-dam, for the purpose of supplying the workmen, who carry on the various manufactories erected on the mill-dam, and their families, with fresh water. The surface of the water in the well was found, by a survey, to be somewhat higher than any of the ground through which the aqueduct passed. The whole length of the aqueduct was about 6000 feet, and its general course was through a salt marsh; in its way, however, it passed under the bed of two creeks, which may be taken at 12 feet deep, each, and near its termination, it descended from the marsh to the bed of the bay on which the mill-dam is built. It was laid about three feet beneath the surface of the marsh, and opened into a reservoir at the city mills, four feet below the level of the surface of the water in the fountain well.

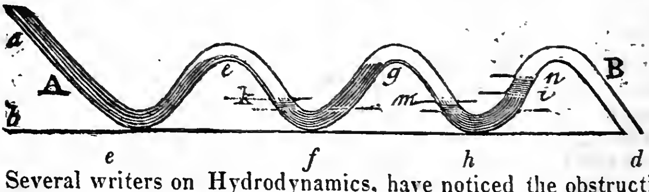
After completing the aqueduct and opening it into the well, it was found that not a drop of water would run through it. As it was known that there were no mechanical obstructions in the pipe, it was thought not a little anomalous that the water should not pass through it.

In this state of things I was requested, by those interested in the aqueduct, to consider the circumstances, and endeavour to procure a passage of the water. When the exact condition of the aqueduct was taken into consideration, I perceived that the water let into it might have made such an arrangement, in relation to the air with which the pipe was previously filled, as wholly to obstruct its passage. For let us suppose in the annexed figure, A B to represent a pipe open throughout its length, but its sides being perfectly tight, and having the several vertical flexures here represented, and let it be

required to pass water, or any heavy fluid, through it in the direction from A to B, the end A being elevated the distance *a b* above B, *c d* being a horizontal line. It is evident, that the water being let into the end at *a*, will pass and fill the pipe to *e*, displacing all the air with which the pipe, being open to the atmosphere, was previously full. Flowing over the curvature *e*, in a stream or column less than the bore of the pipe, it fills the curvature at *f*, without displacing the air previously contained in the descending section from *e* to *f*. This air is thus shut up, and cannot pass from the pipe in any direction, without passing under the water, which, from its inferior specific gravity, is impossible. The water, continuing to flow over the flexure *e*, rises from *f* to *g*, and flowing over this flexure, the same thing is repeated, as to the air from *g* to *h*, which took place at the flexures *e* and *f*. Rising from *h* until it attains some point, *i* for example, at which the sum of the perpendicular heights of the ascending columns *c e*, *f g*, &c. is equal to the height of the column *a b*. That is, if we suppose the air to be un-elastic and void of weight, but as this is not true in fact, the air will be condensed in a greater or less degree, according to its volume and the height of the columns of water opposed to it. In consequence of this condensation, the water will rise, as shown in the figure, to *k* and *m*, for example, and the weight of these columns being added to the effective force of the column *a b*, produces a rise of the water to some point, *n*, in the flexure *h n*. There is then a perfect equilibrium in the opposing forces, and the water can flow no farther. This equilibrium may be expressed, generally, by

$$a\,b + c\,d = b\,e$$

in which *a* is the perpendicular height of the water in all the descending flexures; *b* its density; *c* the perpendicular height of all the enclosed air; *d* its mean density; and *e* the perpendicular height of all the ascending columns of water.



Several writers on Hydrodynamics, have noticed the obstruction which air often presents to the passage of water in bent tubes; but in the works that I have had an opportunity of consulting, the authors appear to regard the air as collecting in the high parts of the tube, and partially closing its bore, thus diminishing, without totally obstructing, the discharge. This is quite different from the effect of the arrangement which I have attempted to explain. Those, however, who are acquainted with this subject, will recollect the Zurich machine for raising water, invented many years since, as owing its efficacy to an arrangement which the air and water take in a spiral tube, very similar to that stated in the preceding part of this paper.

As the aqueduct at the mill-dam was more or less bent through

its whole course, the flexures being considerable at the creeks under which it passed, it appeared to me certain that it was partly filled with air, and that this alone interrupted the flow of water. On opening small holes into it in several places, air rushed out in great quantity; still, however, the water did not flow at the reservoir, and as it was impossible to get at the bendings in every part of the pipe, without the labour of uncovering it wholly, the design of freeing it from air by piercing it with small holes, was suspended. A forcing pump was then coupled to the upper end of the pipe, and water, which had been heated in the worm tube of a distil house, in the vicinity, was forced into it. The pump was furnished with a valve loaded with a weight equal to a column of water 80 feet high, and a very small opening made from the aqueduct into the reservoir at the mills, so that the water passing slowly through the whole length of the aqueduct, was there discharged. The object of this apparatus, was, to produce an absorption of the air, by bringing it in contact, under heavy pressure, with water which had parted with some of its air, by being heated; as these conditions are known to be favourable to the absorption of air by water. The pumping was continued about ten days, and the quantity of water used may be taken at 20 hogsheads; when the pump was taken off, and the aqueduct opened into the fountain. The water was then found to flow at the reservoir, discharging as much as was due to the head. This discharge has continued uninterruptedly to the present time, about five months. There can be no doubt but much air was absorbed, its presence in the aqueduct being indicated, when the pumping was commenced, by its throwing a stream of water out of the pipe, on which the loaded valve was placed, whenever the weight was removed from the valve. The quantity of water thus thrown back was much too great to have been produced from the elasticity of the water, or the lead pipe, and it diminished daily, having almost ceased before the pump was taken off. [*Ib.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS GRANTED IN NOVEMBER, 1828.

With Remarks and Exemplifications by the Editor.

1. For a mode of *Applying Steam for Extracting Tannin,* and other ingredients, from the bark, and other substances used in tanning; William Coburn, Gardiner, Maine, November 1.
(See the specification.)

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2. For an improved *Plough, for Ploughing Hill-sides,* denominated the 'Hill-side Plough;' Norman Staples, Penn's Store, Patrick county, Virginia, November 1.

The object to be attained by the use of this plough, is the turning of the sward down hill, in horizontal ploughing, in both directions.

To accomplish this, there are two shares and mould boards, placed on the opposite sides of the beam; when one of these is in the ground, the other is, of course, turned up into the air. On arriving at the end of a furrow, the plough is inverted; that which was the upper share, being now turned into the ground.

The plough handles turn upon a pin at the end, by which they are affixed to the beam of the plough, so that when the instrument is inverted the handles may be made to assume their proper position. They are secured by a spring, to either end of a piece of timber in the form of a segment of a circle, attached to the end of the beam for that purpose. In the drawing which accompanies the description, each handle is represented as forked, or split at the end, and the divided part bent in opposite directions, so that it may be held conveniently either way. The patentee says, "I claim as my invention the use of one more share than is commonly used, and the spring, the circular pieces of wood in the beam, or, in fact, the particular construction of the whole, in order to turn the sward down hill."

There is in the Patent office a model of a plough, deposited there in January, 1815, by John Brown, which is perfectly similar to the foregoing in all its essential features. It does not appear to have been patented, probably, because there are others of still older date, which are constructed in the same way.

A double plough, intended to answer the purpose of the foregoing, was patented by John Cromwell, of Maryland, in 1816: in this plough there are two mould boards and shares of the ordinary construction, turned back to back, and a moveable beam, to which the horse is attached, turns upon a pin on the centre of the fixed beam which unites them. The horse and moveable beam turn round at the end of every furrow, they being confined together, temporarily, by proper catches; the right and left handed ploughs are thus, alternately, brought into action.

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3. For an improved *Thrashing Machine;* Samuel S. Allen, Skeneatelas, Onondago county, New York, November 1.

A cylinder, with teeth, is made to turn horizontally; beneath this is a fixed concave segment of a cylinder, forming about one-sixth of a circle, which is also set with teeth, which are to separate the grain from the ear.

A feeding apron, moved by rollers, in the usual way, carries the grain forward between the cylinder and the concave segment.

The concave segment is made of separate strips of timber, which are capable of being placed at different distances from each other, by the aid of wedges, screws, or other contrivance. The teeth are not to be inserted vertically, either in the cylinder, or segment; and particular angles of inclination are given, such as the patentee thinks the most advantageous; their distances apart are also designated, and the direction of the lines in which they are to be set.

The specification ends thus: "The above form and size of the

various parts of the machine, are convenient in their construction, but may be varied at the pleasure of the builder; especially where great water power can be easily obtained, a larger machine will, of course, be more useful and expeditious in its operations."

"I claim as an important improvement, the arrangement and inclination of the teeth, in the bed, or curb, of the machine, by which arrangement the grain is readily introduced into the machine, and a great saving of power is thereby effected, the straw is less broken, and the operation of thrashing is performed in a much neater and more cleanly manner. Also in the construction of the bed in separate pieces, with keys and mortises, screws, wedges, or otherwise, whereby each alternate piece may be moved in an opposite direction, and the operator is thereby enabled to increase, or lessen, the space between the teeth in the bed and those on the cylinder, at pleasure, and adapt it to the thrashing of various kinds of grain, according to the quality, or the damp or dry state thereof."

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4. For an improvement in the *Manufacture of Malleable Iron*, and an improved *Bloomery Furnace;* Benjamin B. Howell, Philadelphia, November 6.

(Specification, with a plate, in this number.)

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5. For *Collars for Dress Coats* and outer garments; Henry Clark, Brooklyn, Windham county, Connecticut, November 7.

The specification states that "the aforesaid collars are to be manufactured from wool, fur, and hair, separately, or combined, in the same manner that the said materials are now manufactured into hats; and to be worked on blocks, shaped to any pattern you design for the collar, and stiffened with the kind of stiffening known by the name of 'water proof.'"

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6. For an improved mode of *Drawing and Corking Sparkling Liquors*, with a view to the preservation of their clearness and sparkling quality, (previously acquired,) notwithstanding the drawing and corking of the same; Steen Anderson Bille, New York, November 8.

We were about to make an abstract of the specification of this patent, but have found in it so much of ingenuity, novelty and science, that we have thought its full insertion would be acceptable to our readers, notwithstanding its length. We are aware that many objections may be urged against the plan proposed, and confess, for ourselves, that we should be unwilling to insure the utility of a structure and apparatus like those patented by Mr. Bille. We know, however, that it was the design of this gentleman to have carried his plan into execution, had not an unexpected change in his pursuits called him suddenly to a distant country.

7. For an apparatus for *Saving Heat* in the process of combustion; Steen Anderson Bille, New York, November 8.
(For specification, see p. 401 of the last volume.)

8. For various new and useful improvements in the mode of *Washing, Filling, and Corking Bottles*, more particularly with a view to system, despatch, and cleanliness, in these operations, as belonging to large bottling establishments; Steen Anderson Bille, New York, November 8.

The specification of this patent occupies twenty-one written pages, and is accompanied by three drawings of the machinery to be used for cleaning, filling, and corking. In the operation of cleaning, the bottles are to be placed upon shelves, in an inverted position, their necks passing through holes made for that purpose. Under the neck of each bottle there is a tube standing vertically, its upper end being perforated, so as to throw out numerous jets of water: the lower ends of these tubes are connected to a common reservoir of water, which may be forced from it under a sufficient head, or by a forcing pump. There is an apparatus for lowering the shelves, so that the tubes may pass into the bottles, and reach nearly to their bottoms. When so situated, the water is let on, and rushes into the bottles, which, during the operation, may be raised and lowered by the motion of the shelves.

In the filling machine the liquor to be bottled is contained in a proper box, or vessel, from each side of which project rows of tubes, bent like a syphon, with their open ends downwards. The bottles to be filled are placed in rows, upon shelves, under the tubes: these shelves are to be raised by proper machinery, so that the syphons may reach nearly to the bottom of each. The bottles are to be of the kind blown in moulds, that they may be all of one height, that when the valve is open, which allows the liquor to flow into them, it may rise in each to the proper height for corking, at the same instant, the syphons causing the liquor to stand, in them, at the same level with that in the box.

The corking machine is intended as an improvement upon that of Masterman, patented in England in 1825, and of which an account is given in this Journal, vol. 3. p. 161. The corks are forced by pistons through conical funnels, under which are placed the bottles. Cylindrical corks are preferred, as they expand in the neck of the bottle, and fit it more perfectly at their lower ends, than others. Three-fourths of the specification are occupied by a description of this machine, which is too complex to be understood without drawings; it is not, we apprehend, of sufficient general interest to justify the assigning to it the space which it would require.

To insert the words of the claim, would be to repeat much of what we have said above; it is therefore considered unnecessary.

9. For an improvement in the mode of *Cutting of Pins, Rivets, Bolts, Bars*, and other pieces, from wire, rods, and bars, of

iron, steel, and all other metals, without bruising or marring the end cut off, by machinery, at one operation, called an improved cutting machine; Abiel Stevens, Essex county, Massachusetts, November 11.

The machinery consists of two steel plates, one of which forms a bed, and the other is made to revolve, or slide upon it. These plates are to be accurately fitted, and well hardened; they are to be perforated so that the wire, or bar, to be cut, may pass through both plates, the holes nearly fitting the wire, or bar; by causing one plate to revolve, or slide, upon the other, by means of a lever, or other power, the operation of cutting will be performed.

The principle upon which the above machine operates, is precisely similar to that of the shears or cutters used in cutting off bars of iron in rolling and slitting mills. We do not recollect any instrument exactly in the form described by the patentee, and we think that for cutting round wires, &c., cutters with right angled edges, working like common shears, with semicircular grooves in each cutter, corresponding with the size of the bar, rivet, or wire to be cut, would be more convenient than perforated plates.

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10. For machinery for making *Window-sash, Window-blinds,* Doors, Fence, all kinds of cabinet-work, Looking-glass frames, and all kinds of small carpenters-work; Jedediah Richards, jr., Elbridge, Onondago county, New York, November 12.

This is a machine to saw, plane, and mortise stuff for sash, and other purposes. The description is too obscure and incoherent to convey a correct idea of it, whilst it appears to resemble, in many particulars, other machines which have been heretofore made for similar purposes. The patentee has not informed us what he claims as new, and we are consequently left to infer that he considers the whole as such.

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11. For *Bleaching, or Whitening Leghorn, Straw, and Gimp,* without having recourse to sulphur, or sulphuric acid, &c.; Henrietta Cooper, Washington, Franklin county, Pennsylvania, November 12.

This being a recipe, we omit its publication.

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12. For a machine called the '*Spiral Curvilinear Compressor,*' for expressing water, suds, dye, or other liquid matter, out of wool, cotton, hemp, or any fabric or article formed thereof, by compression between cords, ropes, or chains, operating in spiral curve lines; William Nelson, Batavia, Gennessee county, New York, November 13.

This is, in fact, a *Wringing Machine;* it consists of two standards of stout timber, connected to each other by any proper framing, and standing three feet, more or less, apart. Into one of these standards a circular piece of wood, which is called a head block, is firmly

fixed; a similar piece revolves, opposite to it, in the other standard. These head blocks are perforated with holes, through which a rope is passed, going alternately from one block to the other. The several lengths of rope are then formed into a sort of net work, by strong cord, interwoven crosswise, thus forming a kind of sack, or net, into which the articles to be wrung are placed. By turning the moveable head block, by means of a crank, or lever, the ropes are twisted upon the contained articles, which are thus strongly compressed, and may be wrung nearly dry.

Machines very similar to this have been long known. A Mr. Beetham obtained a patent for one in England, about forty years ago. Their fate, however, appears to have been similar to that of their relatives, the numerous family of the *washing machines*, most, if not all, of which have retired to lodgings in the cellar or the garret, and left the soap-suds in the undisputed possession of the old fashioned washing tub. It is only in manufactories, or large public establishments, that they have continued in use.

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13. For a mode of working, or manufacturing *Slates, and Slate-pencils,* by machinery, called Symington's machinery; Thomas Symington, Baltimore, Maryland, November 17.

We cannot attempt to describe the whole of the machinery referred to in this specification, as it includes not only the grinding, smoothing, and squaring of the slates, but the mortising, tenoning, grooving, and performing other operations on the frame.

The specification is of great length, the whole of the machinery, and its operation, being described with great minuteness; but no particular claim is made to any part; of course, the whole arrangement of the apparatus, as applied to this particular object, is considered as new, by the patentee.

The main machine for grinding, consists of a bed formed of cast iron plates, forming a ring of thirty feet in diameter, and one foot in width. These plates are supported by a wall of masonry, or other stable foundation. A vertical shaft, with four, or more, horizontal arms, projecting from it, carry lateral arms upon their ends, beneath which is the apparatus for holding the slates to be ground. From the end of each arm, sand is made continually to drop upon the cast iron bed, and when the slates have been sufficiently ground, they are transferred to the smoothing machine, the bed of which is of fine grit, where their surfaces are finished.

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14. For an improvement in the *Plough,* called the bar-share plough; John Deakyne, Petersburg, Virginia, November 18.

The specification of this improvement is very brief; we therefore insert the whole of it, which is in the following words.

"The improvement in the bar-share plough, is as follows, to wit: The iron rod which confines the share and beam together, is placed immediately behind the front edge of the mould board, which is of

cast iron, and directly in front of the stand post. The benefit of this improved position is, that it leaves the edge of the mould board to form a complete cutter, by itself, without any obstruction; and it thereby renders the plough less liable to be choked, or impeded by grass and weeds; it also dispenses with the use of a wrought iron cutter placed on the point of the share, and running up through the beam."

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15. For an improvement on the '*Machinery for Moulding and Pressing Bricks at one Operation*,' for which a patent was granted to James M'Donald, of the city of New York, on the 24th day of April, 1827; James M'Donald, and Robert M'Queen, jr., New York, November 19.

The original patent, granted in 1827, was for machinery to manufacture bricks direct from the clay, without going through the usual process of mixing it into mortar. It is merely to be divided into pieces sufficiently small to pass through a screen with wires half an inch apart. This is effected by a machine called the *Granulator*, which contains knives or cutters, worked by the power which drives the principal machine.

A moulding and pressing wheel of cast iron, is fixed on a strong vertical shaft; upon its circumference or rim, are twelve or more cavities of a proper size and form to mould a brick. Into each of these work moulding and pressing slides, by which the brick is consolidated, after which it is made to advance over, and fall through, an opening, and is received upon an endless band, by which it is carried to the place of delivery.

The clay is contained in a hopper, from which it passes by its own gravity into the moulds.

We do not attempt to describe the slides, pistons, cams, friction rollers, &c. which are used in, and necessary to the operation, as without a plate, or plates, they would scarcely be understood.

The present patent, whilst it preserves the main features of the machine, makes a number of alterations in its details, as in the situation of its hopper, the manner of feeding the moulds, of delivering the bricks, &c., which, for the reason above stated, must be dismissed with this passing notice.

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16. For *Knot Shuttles*, and machinery by which they are operated, for the purpose of tying knots to be applied to the making of weavers' harnesses, seines, nets, netting, fringes, &c.; John Thorp, Providence, Rhode Island, November 20.

It was intended to give the specification of this invention entire, with an engraving from the well executed drawing which accompanies it, but the inventor mentions, in a letter recently received from him, that he has found several alterations necessary, which will vary it so materially as to require a new patent. When this is completed, we will fulfil our first design.

17. For an improvement in *Spinning and Twisting*, consisting of a whorling or rotary ring, and revolving hook, (which are intended to answer the purpose of the common flyer,) and the connexion of the bobbin and spindle; John Thorp, Providence, Rhode Island, November 20.

This we will hereafter publish, with a drawing.

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18. For an improvement in the *Spinning of Filling and Slack Twisted Yarn;* John Thorp, Providence, Rhode Island, November 20.

This will accompany the foregoing.

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19. For an improved *Rail-way Carriage;* Wm. Howard, Esq., U. S. Civil Engineer, Baltimore, Maryland, November 22.

For specification, with plates, see p. 66.

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20. For an improvement in the construction of *Steam Boilers of Steam Engines;* Anthony Hermange, Baltimore, Maryland, November 26.

The specification, with engravings, will appear in the next number.

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21. For certain improvements in the machinery for *Propelling Ships and other Vessels;* Anthony Hermange, of the city of Baltimore, Maryland, and Paul Steenstrup, of Konigsberg, in the kingdom of Norway. Issued in conformity with a special act of congress, passed for that purpose. November 26.

Several modes have been devised, both in this country and in Europe, to cause the paddles of the wheels by which steam boats are propelled, to revolve upon their axes, so that they may enter, and leave the water, with their planes vertical to its surface, and a number of patents have been obtained for different modes of effecting this object. The present patentees propose sometimes to work paddle-wheels entirely under the water line, and apprehend that they shall be able to propel vessels as rapidly, if not more so, than in the ordinary mode; whilst in ships or boats where they are so placed, there will be but little sensible agitation of the water, which will add to the comfort of those on board, and render the machinery more durable, whilst the wheels will be protected from cannon shot.

When the paddles are all placed under the water, they are made so to revolve upon their axes, that at the upper part of the wheel to which they are attached, their planes are horizontal, or at right angles with those at the lower part.

The drawings which accompany this patent are large, and, though complex, perfectly descriptive. We are of opinion, however, that in practice no advantage will be derived from causing the paddles to revolve on their axes, but that more will be lost by every mode of

producing this result, than will be gained by their acting vertically upon the water. If, however, it be desired to immerse the wheel completely, the modes proposed will render this practicable, and under these circumstances might be adopted with advantage. Should the patentees test their plans by carrying them into effect upon a large scale, which they intend to do, and the result should be favourable, we shall with pleasure not only make the fact known, but have all the engravings executed which may be necessary to the description of the invention.

The specification, and the explanation of the drawings, occupy upwards of twenty very closely written pages.

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22. For improvements in the machinery for *Propelling Ships and other Vessels;* Anthony Hermange, Baltimore, November 26.

A patent under the same title was obtained by this gentleman on the 31st of May, 1828, and the present is in continuation of that patent, being for certain modifications of the principle upon which that was founded. It may also be considered as connected with that granted to him and Mr. Steenstrup.

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23. For an improvement in the *Boot-tree;* Joshua Ayars, Brookfield, Madison county, New York, November 27.

The object proposed, is, to stretch or raise a boot at the instep, and to swell the lower part of the leg, which is done by turning a screw passing through the boot-tree, which, acting upon pieces of iron, produces that effect.

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24. For *Improving the Shape, Carriage, Action, and Powers of Horses*, by a new method of feeding them; Aaron Carman, Hyde Park, Dutchess county, New York, November 27.

"The peculiarity of his method is, to feed horses and colts by placing the food, whether it be hay or grain, as high above their heads as can be done, allowing the animal to eat with ease to himself."

The method of feeding on the ground, or from box mangers very little elevated, generally not higher than the breast of the horse, is considered as injurious, as colts, from the period of weaning, are, during the time they are eating, which is supposed to be three-fourths of their whole time, kept with their heads and tails down, and their feet in a position unfavourable to shape and action. The evils which are supposed to result from this practice, are stated at length by the patentee.

The improvements claimed, are, first, the elevation of the manger, so that "the horse can barely get his head over the perpendicular side of it, next to him, so as to reach his food, lying in the bottom of the manger." As this height should be adapted to that of the horse, the manger is made to slide up and down between posts.

Every mode of effecting the same object is claimed as appertaining to the principle upon which the improvement is founded.

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25. For a mode of manufacturing *Pressed Brick and Tile*, at one operation, by a machine called 'Parker's Brick Press;" James Parker, M. D., Gardiner, Kennebeck county, Maine, November 27.

A strong wooden bench is placed horizontally; at one end of this is a brick mould, made of iron, cast in one or more pieces. A piston slides into this mould, having a rack at the back of it, into which a pinion works, which is moved by a lever. There is also another lever, or treadle, below the bench, upon which the foot is to be placed, by which a powerful pressure is made upon the end of the rack, in aid of that given by the hand, which moves the lever and pinion. A second lever under the bench, to which the foot is shifted after the brick is pressed, raises it from the mould and delivers it upon a board, when another is placed in the situation to be pressed.

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26. For an improvement in the *Wicket or Paddle Gate* and its fixtures, for the locks of canals; John F. King, Waterford, Saratoga county, New York, November 29.

The general construction of this gate is the same as usual, the novelty claimed is in the following words:

"What I claim as my improvement in the above described gate and fixtures, is the gate, together with the gudgeons, or pivots on which it turns, being made of one entire piece of cast metal, instead of those heretofore used, made of wrought iron, or this and cast iron together, or of wood and iron. I likewise claim the manner of securing the top gudgeon by means of a slide, instead of a clasp or hasp and bolts, or staples, as heretofore used."

The manner of securing the upper gudgeon above referred to, is, by one half of the box, or bearing, within which it works, sliding upwards in a dovetail, or groove, so that it may be removed and replaced under water.

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27. For a machine for *Proving Hemp and Chain Cables;* John Judge, Washington city, D. C., November 29.

The power is obtained, as in some similar machines, by compound levers with long and short arms. What is claimed as new, is the making the bearings, or fulcrums, of all the levers in the form of those of a scale beam, usually called the knife edge suspension, the whole being made true and hard, the friction is consequently reduced to a mere trifle.

Specifications of American Patents.

Specification of a patent for a mode of applying Steam for Extracting Tannin and other ingredients, from the bark, and other substances used in tanning. Granted to William Coburn, *Gardiner, Maine, November* 1, 1828.

"This improvement consists in applying *steam* to the substance from which tannin is to be obtained, in the following manner. The steam is conveyed from the boiler by a tube, into the lower part of a *cistern*, or *tub*. The tub, or vessel, used for the purpose, is furnished with a false bottom, perforated with holes, and raised a few inches from the true bottom. The tub is filled with the substance to be acted upon by the steam, which is suffered to pass into the tub between the two bottoms. Cold water, or bark liquor, is then, occasionally, poured into the top of the tub, and the liquor thus obtained is drawn off by means of a cock placed between the bottoms of the tub. The advantages of this mode, are, 1st, the simplicity of the apparatus necessary for the application of the steam; no pressure is required to confine the steam in the tub, other than the weight of the materials acted upon. 2nd. By the application of cold bark water, or liquor, or cold water, the steam is found to penetrate the substance much more easily, and a greater quantity of tannin is obtained. This form of apparatus, and the method, is very useful and convenient for extracting glue from the substances which contain it; also for lixiviating wood, or other ashes, either for *potash*, or *soda;* for the colouring ingredients of dye stuffs, the active principles of medicines, &c. William Coburn.

Remarks by the Editor.—We are at a loss to perceive any advantage to be derived from the separate boiler, from which the steam must be conducted through a tube, down between the two bottoms. Why would not the boiler itself answer all the purposes required? There might be a false bottom, or grating, upon which the bark or other materials might rest, with the fire under the true bottom; there would, in this way, be less loss of heat, and more steam generated and applied to use, than by the plan proposed. "Wood, or other ashes," would soon find their way between the two bottoms; and even if they did not, the solubility of the alkalies is such as not to need the aid of steam; and if they did, the steam, applied in this way, is no more than boiling water.

Steam has been repeatedly applied to the heating of water in vats and coppers, by carrying tubes to the lower parts of these vessels. The principal advantages proposed have been, the obviating the risk of injuring the contained materials by the direct action of the fire, the preservation of the vessels themselves, and the heating of several by attending to a single fire.

Specification of an improvement in the mode of drawing and corking Sparkling Liquors, with a view to the preservation of their clearness and sparkling quality (previously acquired,) notwithstanding the drawing and corking of the same. Issued to Steen Anderson Bille, *New York, November* 8, 1828.

This invention consists in performing the operation of drawing any sparkling liquor, as malt-liquor, or cider, from one or more vessels, and filling one or more other vessels with it, as also of closing it firmly in such one or more other vessels, by corks, plugs, or stoppers of any kind, the whole under an artificial *pressure*, by means of compressed air, corresponding with, or in some measure exceeding, the sparkling power of the liquor in question; thereby preserving unimpaired, such sparkling power of the liquor, as well as its clearness, (both being the result of repose and pressure,) notwithstanding the drawing and corking of the same.

To effect this, an air chamber is constructed, sufficiently strong to retain the air, compressed to any degree required, and sufficiently spacious to allow the whole operation above stated, to be performed within its walls.

It having been fully ascertained, by the use of diving bells, that the lungs of man are not effected, in any manner injurious to health, by breathing air, for a limited time, under an artificial pressure of one or two atmospheres in addition to the common atmospheric pressure, there can, of course, be no reasonable objection to one or more persons, as the work may require, closing themselves up in an air chamber of the above description, similar in its operation on the human frame, to a diving bell, descending in the water to a depth producing a similar compression of the air within. The air in both vessels, viz. in the diving bell and in the air chamber for the drawing and corking of sparkling liquors, is maintained in its purity for animal breathing, by the application of an air-pump; and while the pressure in the diving bell is produced by, or depending upon, the depth to which the bell shall be sunk, the pressure in the air chamber for the drawing and corking of sparkling liquors will be produced by the air-pump, and will be depending upon a relieving valve, not admitting the pressure within to exceed the weight by which the valve shall have been previously regulated, with a view to the contemplated operation; or if a column of water be substituted for a valve, then the weight of such a column of water, which latter medium possesses the additional advantage of counteracting any little variation which change of temperature may occasion in the expansion of the air within, by either receding from, or filling up, the space of any vessel into which the end of the tube shall be immersed.

If the fermented liquor to be operated upon, be placed in an air chamber of this description, in *open vessels*, it is evident that the development of carbonic acid, or rather the escape of it in the shape of gas, will, by the pressure of the compressed air, contained in the

air chamber, be as effectually checked, to the extent of such pressure, as if the liquor were kept within corked bottles. On the contrary, as far as the chemical energy of the fermented liquor in forming carbonic acid, and emitting it in the shape of gas, exceeds the pressure of the compressed air intended for its suppression, the fixed air will naturally escape; this, however, is so far from being a disadvantage, that it actually is a most desirable circumstance, affording the means of relieving the liquor from any excess of expansive force, which, otherwise, might endanger the vessels intended for its keeping. Thus the sparkling power of the liquor may be governed and controlled at pleasure, as well with a view to its safety in keeping, as its fitness for a beverage.

When the liquor shall have been kept a sufficient time under pressure in the air chamber, to have acquired the sparkling quality desired, either by fermentation or by some other chemical process, it may be drawn off into bottles, and corked perfectly clear (leaving the sediment in the vat,) and perfectly sparkling, ready for immediate use, as though it had been kept all the while within bottles; provided such drawing and corking of the liquor be performed in the air chamber, that is to say, under the pressure to which the liquor till then shall have been subject. The best proof of this fact is, the flat appearance of any sparkling liquor while under pressure in the bottle, notwithstanding the motion given to the liquor by turning or upsetting the bottle in which it is contained. It may, therefore, in a similar manner, be handled without any loss whatever of its acquired qualities, in pouring it from one vessel into another, provided only as above stated, the pressure be preserved during the operation.

The fermented liquor to be operated upon, is introduced into the air chamber by means of a cylinder, without the air chamber, placed horizontally, or nearly so, above the height of the vats within, intended for the reception of the liquor. This cylinder is furnished with four tubes and cocks, two communicating with the air chamber, viz. one on the top of the cylinder, communicating with the air in the air chamber, the other at the bottom of the cylinder, communicating with the spout leading to the vat within, intended for the reception of the liquor; and two communicating with the atmosphere, the one at top with the air, the other at bottom with the liquor to be introduced; thus, by alternately shutting and opening the respective cocks, the liquor may successively be supplied to the cylinder, and emptied into the vats in the air chamber.

For the admission of the person to perform the operations of drawing and corking the liquor, a manhole is formed in the top of the air chamber, having a lid inside, which closes hermetically, by the pressure of the air within. A moveable cylinder, closed at top, covers the person who is to enter; this cylinder is screwed air-tight to the rim or flanch of the manhole. On opening a communication between the air chamber and the cylinder by means of a cock, the state of the air in both will be equalized, and the entrance through the manhole thereby rendered perfectly free. On leaving the chamber the same way, the manhole is shut, and a communication opened

between the cylinder and the atmospheric air, which will relieve the cylinder from the compressed air within, and thus allow the cylinder to be removed to let out the person shut up in it.

The bottles are introduced into the air chamber, and again delivered out from the air chamber, through one or more boxes attached to the chamber, having a door at each end; the one opening into the air chamber, and the other communicating with the atmosphere. The bottles are placed upon a moveable shelf, and thus introduced into the box; closing the door and opening the cock of a tube connected with the box and the air chamber, the air in both will be equalized, and thus the entrance into the air chamber rendered free. By reversing the operation, the shelf with its bottles may, in a similar manner, be let out. If two boxes be made use of, some saving may be made in the expenditure of compressed air at this operation, by equalizing the air in both the boxes, the one for letting in, the other for letting out, before any new communication is opened, either with the air chamber or the atmosphere, as the case may be.

The application of four boxes will be still better, with a view to despatch in receiving, filling, corking, and again delivering out the bottles, agreeably to a new plan, invented by the undersigned for performing these operations. If the liquor is to be drawn off in vessels larger than bottles, as barrels or casks, such vessels, being necessarily perfectly tight and strong, are placed near the air chamber, from which two pipes are made to communicate with the top of the vessel, by two corresponding holes and sockets, or flanches, in the vessel; the one for equalizing the air in both, the other for drawing the liquor from the vats in the air chamber: thus, by turning the respective cocks, the above operation may be performed at pleasure.

To prevent any mustiness forming on the top of the liquor in the vats in the air chamber, in consideration of a more extended surface of the liquor being in contact with the air in this way, than when closed up in bottles, but still more so with a view to the air in the air chamber being constantly renewed for the sake of respiration, the surface of the liquor ought to be covered with a floating lid, or top piece, having only a trifling space open round its edge to prevent it from sticking to the vat, and this little space may still further be closed up by some liquid, lighter than the liquor in the vat, as water, spirit, or sweet oil, not easily affected by the air, nor affecting itself the liquor.

With a view to the safety of the person entering the air chamber, a pliable tube may be attached to the opening inside, through which the air is forced into the air chamber by the air-pump, necessarily at work when any person is engaged in the chamber, which tube, when taken up by such a person, or placed near to him only, will infallibly secure to him a current of air, abundantly sufficient for respiration; besides which, the whole air in the chamber may, occasionally, be renewed for the same purpose as above stated, and even before entering the chamber, the actual state of the air may be fully ascertained by cocks, communicating with the interior, and, if required, a general purification then be effected by the air-pump. If

an additional air-pump be applied for the emission of air from the lower part of the chamber, the carbonic acid gas being the heaviest, while, by the other pump, air is forced into the upper part at the same ratio; the connexion of both with a common fly wheel, will counterbalance the power required for the latter operation, leaving only the friction to be overcome, which will facilitate the purification of the air within to such a degree as to admit of keeping it constantly as pure as the air without, whatever the size of the chamber may be, by the mere overcoming the friction of the air-pumps thus applied. Light is best admitted by reflection from without, to avoid any inconvenience from the direct application of lamps within.

To shorten the time necessary for any person to stay in the air chamber, it is desirable that such improvements in the drawing and corking of liquors should be adopted, as will facilitate this operation; such improvements, however, forming no part of the present invention, it is unnecessary here to enlarge upon the subject any further.

With regard to the construction of the air chamber, strength and tightness constitute the qualities indispensably required; these may be obtained in different ways, but it is presumed to be the cheapest plan to give to the air chamber a circular shape, by which the two sides are made to form, as it were, one cylinder within another, kept together by square frames of beams, placed vertically at suitable distances, radiating as it were from a common centre, and enclosing at the same time both top and bottom, while the whole is lined with planks, forming an entire box, to be covered internally, with some substance fit to render the chamber air-tight, as zinc, or lead in sheets. If the width, or height, be too great for the frames to sustain the pressure from within, bars of iron may be applied in support of the middle of the beams; by thus connecting the cross beams of the opposite sides, as well as those of the top and bottom, which will not materially interfere with the application of the space within, to the purposes intended.

When the air chamber shall be duly protected against the variations of the temperature of the external air, the temperature of the air within may be kept pretty uniform, or at any degree required, by suffering the air, in entering the chamber, to pass through a cooling, or a heating vessel, as the case may require.

Although several advantages, as above stated, will result from the application of an air chamber, in keeping quantities of liquor under pressure for the purpose of rendering them clear and sparkling, the subscriber does not claim such advantages, generally, as his invention; but he confines himself, in his claim of invention, to the mere drawing and corking of sparkling liquors *under pressure*, by means of an air chamber, containing air compressed to any degree required, whereby the clearness and sparkling quality of the liquor, previously acquired, either in the air chamber or elsewhere, will be preserved unimpaired, notwithstanding the drawing and corking of the same.

STEEN A. BILLE.

The Patent Thomsonian Practice of Physic.

The above dignified title is used to designate the administration of certain vegetable preparations, and the employment of the steam bath, in the cure of a number of disorders. To these medicines, and the mode of administering them, an exclusive privilege is claimed, under a patent from the United States. Several instances have been narrated in the public papers, of the fatal effects of this practice, whilst those interested in its favour, assert that these accounts have been falsely represented by the medical faculty, who, they aver, have risen in arms against it, because it is destroying their practice. The support of a number of intelligent and disinterested persons, has given currency to the claims of these Thomsonian practitioners; and, under this sanction, their business has become very extensive, particularly in some of the western states. Without intending to express an opinion upon the subject, we will observe that it is the fate of every popular medicine, to obtain the kind of support which the practice in question has received. Such preparations are usually active, and, when properly administered, they are beneficial; their indiscriminate employment, therefore, will insure their occasional usefulness. Whenever they are successful, the cured, and their friends, naturally enough, praise the medicine; whilst the patient, the disease, or the physician, bears the blame, when their effects are injurious.

Numerous applications have been recently made for copies of Mr. Thomson's specifications, as questions have arisen which will call the merits of the practice, and of the practitioners, before a court and jury. Under these circumstances, we think that the publication of both the patents which have been obtained by Mr. Thomson, may subserve the cause of science, and of humanity. The first patent expired on the 2d of March, 1827, the second having been issued upwards of four years before the termination of the period of the first. In some parts they appear to be identical, as in No. 2, in both specifications, and in other parts also. Under these circumstances, the question may arise, whether the claim under the second patent is not, in fact, an attempt to prolong the first, as it does not specify the particular improvements claimed, but appears, broadly, to include the whole practice recommended.

Specification of a patent granted for "Fever Medicine." *To* Samuel Thomson, *of Surrey, county of Cheshire, New Hampshire, March* 2, 1813.

A specification for preparing and using certain medicines in fevers, colics, dysenteries, and rheumatisms.

No. 1. The emetic herb, or Lowbela (Lobelia?) medica, a plant that grows about twelve or fifteen inches high, with leaves of the size of mint leaves, bearing a pod the size of a white bean, of a

sharp taste, like that of tobacco, creating nausea. It must be gathered when the leaves and pods are a little yellow; dried, pounded fine, and sifted, when it forms a powerful emetic. Dose, in powder, from 4 to 12 grains, with or without an equal quantity of No. 2.

No. 2. Cayenne, or red pepper, pulverized.

No. 3. Marsh rosemary, two parts, the bark of bayberry, or candleberry (the myrtle from which wax is obtained from the berry) roots, one part, pulverized, or sumach bark, leaves, or berries, or raspberry leaves, may be substituted. A tea made with one ounce of the above powder (No. 3,) in a pint of boiling water. Dose, a wine-glassful, occasionally, sweetened.

No. 4. Bitters for correcting the bile; take the bitter herb, or *balmony*, barberry bark, and poplar bark, equal parts, pulverized. One ounce to half a pound of wine, or spirit, and hot water. Dose, half a wine-glassful, and for hot bitters, add half a drachm to the ounce.

No. 5 A sirop. Take one ounce of peach kernels, or cherry stones; half an ounce of gum myrrh, made fine; add three half pints of hot water, two ounces of white sugar, half a pint of brandy. Half a wine-glassful to be used three times a day.

Rheumatic drops. Take one gallon high wines, one pound gum myrrh, put into a stone jug, and boil it in a kettle of water for half an hour; when settled, pour it off; add four ounces camphor, half an ounce of cayenne pepper in powder, one quart of spirits of turpentine, then bottle it, and it is prepared for bathing in rheumatisms, any swellings, or external pains.

No. 1, is used to cleanse the stomach, overpower the cold, and promote a free perspiration. No. 2, to raise the inward heat. No. 3, to scour the stomach, promote perspiration, and repel the cold. No. 4, to correct the bile, and quicken the appetite. No. 5, to strengthen the stomach, and restore the digestive powers, after cases of dysentery, or other weakening disorders. The three first numbers may be used in any other case, to promote perspiration, or as an emetic.

SAMUEL THOMSON.

Specification of a patent granted for a mode of preparing, mixing, compounding, administering, and using, the medicine therein described, to SAMUEL THOMSON, *of Boston, Suffolk county, Massachusetts, January* 28, 1823.

First. The mode of preparing and compounding medicine for an emetic, to be administered in diseases caused by cold and obstructed perspiration, such as fevers, colic, rheumatism, dysentery, asthma, numb-palsy, dropsy, and consumption, and various others.

Take the emetic herb *Lobelia Inflata* of Linnæus, dry the pods and leaves, or the leaves only, and reduce them to a fine powder in a mortar; sift and keep it from the air. For a dose, take from ten to twenty grains, steeped in warm water, sweetened. This emetic is called by the patentee, *number one*, in his system of practice in medicine.

The emetic herb, or *Lobelia*, above-mentioned, is a biennial plant, grows about twelve or fifteen inches high, with leaves of the size of mint leaves, and pods about the size of a white bean, containing very small seeds; is of a sharp taste, like tobacco, exciting the glands of the throat, and producing nausea. It should be gathered when the leaves and pods are turned a little yellow, but is good in any stage of its growth: when perfectly dry, the seeds should be shaken from the pods, and preserved separate.

Another mode of preparing the emetic, *number one*, from this herb, is as follows, to wit: take the green herb, pound it in a mortar, and put it in an equal quantity of spirit; after being well steeped, strain off the liquor, and keep it, close stopped, in a bottle for use. Prepared in this manner, and adding *cayenne*, as hereinafter mentioned in *number two*, two drachms to a pint of the liquor. Dose, one tea-spoonful. This is an effectual remedy in removing the effects caused by poison, either taken internally, or by bathing the part affected. The seeds of this plant are more powerful than the leaves, and one half the quantity pounded fine, and steeped as above described, is of sufficient power for an emetic.

Secondly. To retain the internal vital heat of the system, and cause a free perspiration. Take cayenne, (*capsicum*) or red pepper, ground fine; dose, from ten to twenty grains, in hot water, sweetened, or to be combined with the other medicine hereinafter described. This is called by the patentee, *number two.*

Thirdly. To scour the stomach and bowels, and remove the canker. Take bayberry, or candle berry, (*myrica cerifera L.*) (the myrtle from which wax is obtained from the berries) the bark of the root dried and pulverized; the inner bark of the hemlock tree (*pinus canadensis, L.*) pulverized, equal parts of each, steep one ounce of the powder in a pint of boiling water, and give, for a dose, a common wine-glassful, sweetened.

When the above cannot be had, take, as a substitute, red sumach bark, leaves, or berries, (*rhus glabrum, L.*) red raspberries (*rubus streorsus of Michaux*) or witch hazel leaves (*hamamelis virginica, L.*) marsh rosemary, (*statice lemonium, L.*) and white pond lily roots (*nymphœa odarata Ait*) or either of them: let them be dried, pounded, and steeped, as above mentioned. This is called by the patentee, *number three.*

When the violence of the disease requires a course of medicine, take an ounce of the foregoing medicine, *number three*, steeped in a pint of hot water, strain off a wine-glassful when hot, and add ten or twenty grains of *number two*, and one tea-spoonful of sugar; when cool enough to be taken, add from ten to twenty grains of *number one*, and an equal quantity of *nerve powder*, hereafter described, to quiet the nerves. Let this compound be administered three times, at intervals of fifteen minutes, and let the same compound be given by injection once, and, if the case requires it, again repeated.

When mortification is apprehended, a tea-spoonful of medicine, *number six*, as hereinafter described, may be added to each dose, and, also, to the injection. After the patient has recovered suffi-

ciently from these applications, which is usually within two or three hours, let the mode of raising perspiration by steam, as hereinafter described, be applied.

Fourthly. To make bitters for correcting the bile.

Take the bitter herb, (*balmony*) Barberry bark (*Barberis vulgaris, L.*) and poplar bark, (*populus trepida*) in equal parts, pulverized. One ounce to a pint of hot water, and half a pint of spirit. For a dose, take half a wine-glassful; for hot bitters, add a tea-spoonful of *number two:* this is called, by the patentee, *number four.*

Fifthly. To make a sirop for dysentery, to promote digestion, and strengthen weak patients.

Take poplar bark, the bark of the root of the bayberry, each one pound, boil them in two gallons of water, strain it off, and add seven pounds of good sugar, then scald and skim it, and add half a pound of peach meats, or cherry stone meats, pounded fine; when cool, add a gallon of good brandy. Bottle it up, and keep it for use. Take half a wine-glassful, two or three times a day. This is called by the patentee, *number five.*

Sixthly. To make rheumatic drops, to be used to remove pain, and to prevent mortification, given inwardly, or to be added to the injections, or to be applied externally.

Take one gallon of any kind of high wines, one pound of gum myrrh, one ounce of cayenne, *number two,* put into a stone jug, the jug being unstopped; boil it a few minutes in a kettle of water; when settled, bottle it up for use. Or it may be prepared without boiling, by letting it stand for five or six days, shaking it well every day, when it will be fit for use.

For bathing, in rheumatism, itch, or other humours, or in angry swelling or external pain, add one-quarter pint of spirits of turpentine. One or two tea-spoonsful of these drops, without the spirits of turpentine, may be given alone, and, also, may be used to bathe with; or, one tea spoonful may be added to a dose of either of the medicines before mentioned. This is called by the patentee, *number six.*

In the earlier stages, and in less violent attacks of disease, a composition or vegetable powder may be administered, prepared as follows, to wit; take two pounds of the bark of the root of bayberry, one pound of the inner bark of the *hemlock tree,* one pound of ginger, two ounces of cayenne, *number two,* two ounces of cloves, all pounded fine, sifted through a fine sieve, and well mixed together. For a dose, take one tea-spoonful of this powder with a tea-spoonful of sugar, in a wine-glassful of boiling water, as soon as sufficiently cool, the patient being in bed, or covered with a blanket by the fire.

The medicine, *number one,* and, also, the nerve powder, hereinafter described, may be used with this compound, and will be proper in more violent cases.

In all cases of symptoms of nervous affection, a nerve powder must be used, which is prepared as follows, to wit. Take ladies slipper, (*cypripedium pubescens,*) dig the roots when done growing, wash them clean, dry and reduce them to a fine powder. For a

dose, take half a tea-spoonful in hot water, sweetened, or the same quantity may be given mixed with either of the other medicines, in all nervous cases.

When the above described medicine, or such part thereof as may be deemed proper to administer, shall have produced the intended effect, a copious perspiration should be produced by applying heat to the body, by the aid of steam, in the following manner, to wit. Let several stones of different sizes be made hot, then put one (the smallest first) into a pan, or kettle, of hot water about half immersed; place the patient over it undressed, covered with a blanket to shield him from the cold air; change the stones as often as they grow cool, and keep the patient in this situation as long as he can conveniently bear it; then he may be rubbed all over with a cloth wet with spirits, or cold water, and either dress or go to bed.

When the patient is too weak to sit, or stand, over the steam, take three hot stones, quench them a little in water, and wrap them in several thicknesses of cloths well wet with water, place one at his feet, and one on each side as he lies in bed, which will produce a lively steam, and with a dose of medicine, *number two*, taken inwardly, will cause a free perspiration.

The preparing and compounding the foregoing vegetable medicines, in the manner herein described, and the administering them, to cure diseases, as herein mentioned, together with the use of steam to produce perspiration, the said Samuel Thomson claims as his own invention. Samuel Thomson.

Specification of a patent for the construction of a Furnace for Generating Steam by Anthracite Coal, and for the use of various Manufactures requiring intense heat. Granted to Benjamin B. Howell, *Philadelphia, October* 14, 1828.

The improvement claimed, consists in the form and principle of the interior of the furnace, and in its being a separate structure from the boiler or other body to be heated, by the means of which the heat is generated without bringing the fuel in contact with the boiler or other body; and in the application of an artificial blast upon anthracite coal, increasing, in a great degree, the intensity of the heat, and giving it the necessary direction through the communicating flues of the furnace, upon the bodies to be heated.

The drawings exhibit a front elevation, a ground plan, and a section; all upon a scale of six feet to an inch.

The exterior shape and proportions may be varied at pleasure, provided the principle of generating and applying the heat, be retained.

With a furnace of this construction, and a moderate blast, the flame and the heat may be carried to almost any required extent under the boiler of a steam engine or other body, using anthracite

coal as fuel. The blast may be obtained by attaching a small pair of tub, or other, bellows, to the engine, and the machinery may be put in motion by using, in the first place, a small quantity of wood. Power enough being thus obtained, to start the bellows, no more wood will be required until after the fire has been suffered to go down and is to be again renewed.

The coal should always be kept, while in full operation, at about the line E, or, at least, so much above the flue B, that it may become perfectly ignited before it sinks to that level. Attention to this is important in preserving a uniform temperature.

The additional power required to propel the bellows, beyond that necessary for the ordinary work to be performed by the engine, will be very small, it is believed not more than a single horse to an engine, of what is called forty horse power, or about two and one-half per cent.; but should it exceed that estimate in a triple proportion, and experience justifies the conclusion that it will not, the economy of room on board of steam boats, where room is so valuable, with other advantages hereafter mentioned, and the saving, in all places, of expense in fuel, will much more than compensate this disadvantage.

But in addition to the economy effected by the introduction into general use for this object, of a fuel existing in inexhaustible quantities in our country, to the exclusion, in many situations at least, of one daily becoming more scarce and costly, a further and important saving will result in the construction of boilers adapted to this furnace; nearly all the space now occupied by the wood, that is, the furnace part of the boiler, may be dispensed with, and in its place be substituted a narrow flue for the passage of the heat under that part of the boiler containing the water. The part that may be dispensed with, forms an expensive part of the whole, while the furnace in which the heat is to be generated, being of a less expensive material, will be much less costly. The great objection to the use of anthracite coal in generating steam, arising from the necessity heretofore supposed to exist, of bringing the fuel in actual contact with, or near approach to, the boiler along its entire surface, is, by this plan, entirely obviated, as the coal is here never in contact with the iron, which, of course, will be much more durable than if constantly acted upon by the direct heat of the fuel.

The principle in the construction of furnaces, and the generation and application of heat by means of anthracite coal and an artificial blast, may be applied with equal advantage to the manufacture of glass, earthenware, pottery, the burning of brick, and all manufactures admitting a like application of heat. B. B. HOWELL.

Notes and references for the improved Furnace for using Anthracite Coal in Generating Steam, and for various manufactures requiring intense heat.

The drawings, Figs. 1, 2, and 3, represent an elevation, a vertical section, and a ground plan, all upon a scale of six feet to an inch; and the same letters refer to the corresponding parts of each.*

* The following errors of the engraver must be corrected. The letter A at

A, A. Tuyeres for introducing blast.

B, B. Line of flue for the passage of flame and heat under the boiler, or other vessel, or body, to be heated.

C, C. Charging doors for coal.

D, D. Cleaning-out doors, occasionally used as draught doors.

E. Line of upper surface of coal.

F, F. Grate bars. Where it is inconvenient to use these, the bottom of the furnace may be closed, as the blast will sufficiently ignite the coal; and the wood first used may be ignited by throwing open the cleaning-out doors, at D, D.

G, G. Openings to promote draught, before applying blast. These may be omitted, in like manner with the bars.

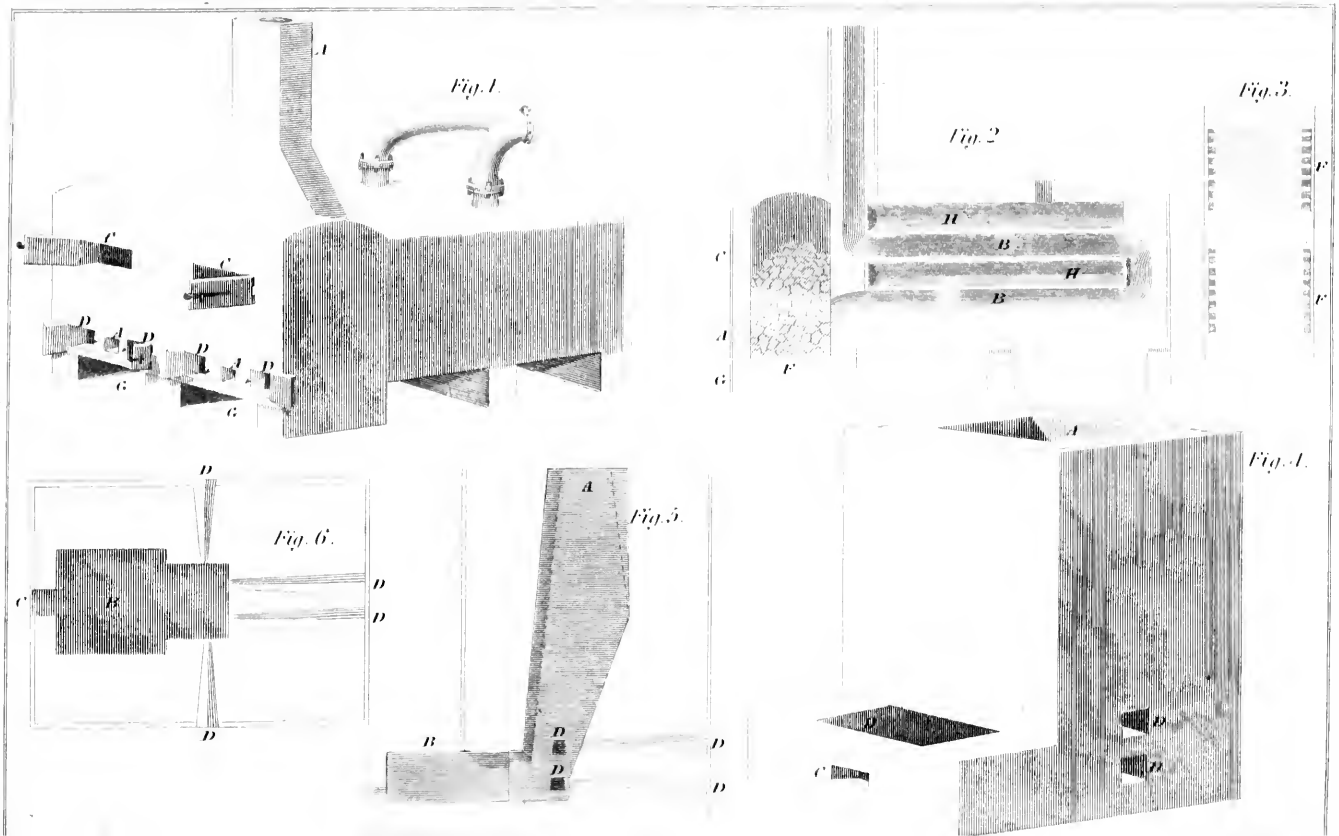
The furnace should be lined with fire brick, and cased with cast-iron plates, secured by strong bolts, screws, and keys; and between these, common brick may be used. If a thin packing, or lining of sand, be also interposed, it will be found useful in preventing injury from expansion. B. B. HOWELL.

Remarks by the Editor.—But a very few years have elapsed since the general impression in Philadelphia, and other places where attempts had been made to use anthracite as fuel, was, that we might as well attempt to burn bricks and stones; yet it is now known to require less management than any other fuel, and those only experience difficulty, who take too much trouble to succeed. After the coals are once placed in our grates, and ignited, their motto seems to be "*Laissez nous faire*," and observing this, every thing proceeds with the utmost facility. When it was admitted, not merely to answer well, but absolutely to be the best fire for our parlours, it was still thought by many, that it would never descend into the kitchen, as it was, from its *very nature*, inapplicable to culinary purposes; but here again it was destined to obtain a triumph. The fireman of the steam engine, and the iron master, however, yet remained unconvinced; these averred that they had given it a fair and perfect trial, and that it would never do; there was still something in its *very nature*, which, in their occupations, forbade its use. You might as well have attempted to convince them that it was fit to be made into candles, as that it might be employed for their purposes, if their furnaces were suitably constructed, and the fuel properly managed. It appears likely, however, that it will soon assert its claims to superior excellence, in these applications also, and triumph over the prejudices of the managers of furnaces, as it has over those of the householder, the cook, and the blacksmith.

That many abortive attempts would precede its successful use, was to have been expected, as it differs in so many particulars from the fuel we had been in the habit of using; but it was evident that an intense heat was given out in its combustion, and if we could only transfer this to the water in our boilers, we must convert it

the upper end of the flue, Fig. 1, should be B. There should have been a letter E, at the upper surface of the coal in Fig. 2.

HOWELL'S BLOOMERY & ANTHRACITE STEAM FURNACES.



into steam; and in like manner, it must reduce the ore, could the heat, and the carbon, be made to operate upon it. That there was nothing in the nature of things to forbid this, we have ever believed, and are now fully persuaded, that, in all cases, excepting where the action of a large volume of flame is necessary, this fuel may be advantageously employed.

When the application was made for the foregoing patent, some of its leading features appeared to us such as to merit particular attention; the more so in consequence of some circumstances mentioned by Mr. Howell, in a letter which accompanied his other papers; in reply to a communication addressed to him, on the subject of his furnace, he says, "I am not surprised that my statement of the effect produced by the flame of anthracite, has somewhat astonished you. That a fuel, which has, heretofore, been supposed incapable of producing *any* flame, should in truth be so powerful in this respect, is really wonderful. But it has, in reality, been hitherto but little understood, and too much has been taken for granted in relation to it. With regard to this particular property, the error has, I think, been caused by the practice of looking at the upper surface of the coal, the flame from which does not, until the coal is fully ignited, yield much heat, and is liable to great variation of temperature, from the necessity of placing there, new supplies of fuel, which, for a long time, gives no heat whatever. In both my furnaces, you will remark, that the heat is first generated in *close* vessels, and thence taken from that part where the heat is uniform, and most intense; under this arrangement, the effect is, indeed, really astonishing. The length of one of the furnaces in which my experiments were made, was about six feet, and the height of the chimney, ten; or the length of the flue, horizontal and perpendicular, fifteen. The quantity of coal did not, I think, exceed a bushel, certainly not a bushel and a half; and yet the bricks at the top of the chimney were *red hot;* and the flame rose full six feet above the top, strong and vigorous."

"I anticipate that the idea of blowing a steam boat fire, with bellows, will be ridiculed; but this, or something like it, will, I am persuaded, be adopted. Perhaps I go too far in thinking that it may be applied to glass-house furnaces, &c. but time will determine."

We think Mr. Howell's remarks highly interesting, and hope soon to hear from him the results of his further important investigations and experiments. For the fact of a flame of six feet in height, from anthracite, we were not prepared; nor are we now of opinion that the flame actually extended from the fire to the top of the chimney, but believe that the flue was filled with heated air, consisting of nitrogen, carbonic acid, and carbonic oxide, and that the latter inflamed on its coming in contact with the oxygen of the atmosphere.

This remark has little to do with the practical utility of Mr. Howell's furnace, and is intended only to apply to the theory of the production of the flame, which issued from the chimney, and which, we apprehend, was not twenty-one feet in length.

Specification of a patent for an improvement in the manufacture of Malleable Iron, and of an improved Bloomery Furnace. Issued to BENJAMIN B. HOWELL, *Philadelphia, November* 6, 1828.

THE discovery consists of an improvement in the construction of the Bloomery furnace,* by means of which, and the use (in the manner hereinafter described,) of anthracite coal, exclusively, for fuel, iron ore is directly converted into malleable iron.

The drawings exhibit an elevation, and vertical and horizontal sections. By these, and the notes and references appended thereto, it will be seen that this furnace combines within itself, the advantages of both a close furnace and an open fire; in this respect differing, essentially, from any other now in use for similar objects. In the upper or close portion, being all that above the hearth, with anthracite coal excited by a proper blast, a degree of heat is obtained, much greater than can possibly be generated in the ordinary fire with charcoal; while the lower portion opening into the hearth, and permitting the free action of blast upon the burthen, performs all the offices of the open fire, or forge. The size of the furnace and the proportions may be varied, if the principle of the close and open fire be retained.

The furnace being first heated up in the manner of a common cupola, the process is thus conducted. The coal having settled sufficiently for that purpose, it is charged with the proper burthen of ore, which will vary according to the quality and kind. The charges are then continued, alternately of coal and ore. The ore soon arrives at the tuyeres in a state of partial fusion, and is then, by the intense heat of that part of the furnace, quickly separated from its earths; and then rapidly descending into, and below the direct action of, the blast, a large part of which is driven out at the open front, first passing over that portion of the ore which has reached the hearth, it is thereby brought, in the language of the workmen, "to nature," or, in other words, into malleable iron.

As it sinks into the region of the blast, the small masses may be driven into one, and a loup shaped by giving a proper direction to the pipes at the different tuyeres, and the loup can be removed with a proper instrument, another instrument, or strong iron bars, being introduced at B, to hold up the burthen while this is doing. The loup may be drawn into a bloom under a forge hammer, or passed through rollers. In either operation it will, of course, be necessary to renew the heats, which may be done in a common chaffery, or in a heating furnace. This process is continued at the pleasure of the workmen, and as soon as a quantity sufficient for a loup accumulates, it is withdrawn, as above described.

In the early stage of the operation it will be necessary to charge the furnace nearly, or quite, to the top; but, as the heat increases, the height of the coal may be gradually diminished, and at a very

* Bloomery is here used in the sense commonly understood in this country.

high temperature, from two to three feet of coal will be found sufficient.

The cinder produced in this way will, in all respects, resemble forge, or bloomery cinder, and will bear working a second time; an appropriate flue facilitates the operation, and, as it is first fused, and sinks, and is thus interposed between the iron at the bottom of the hearth, and the coal, it contributes to prevent a mixture of the two.

Holes may, or may not, be left in the sides of the furnace for the introduction of bars to aid in detaching the iron from the bottom and sides; but this will not often be necessary, if the back of the furnace be thrown sufficiently forward and a proper direction be given to the blast; for which purpose, tuyeres are placed in different positions on three sides of the furnace, and at different elevations. One or two pipes may be used at pleasure.

From the foregoing, it must be obvious that by the rapidity of the process, the saving thereby of time and labour, the substitution of a cheaper, more powerful and abundant fuel, for that now in use, and which is so made applicable to this object, by the peculiar construction of this furnace, that a great and important improvement has been effected in the conversion of iron ore into malleable iron.

B. B. HOWELL.

Notes and References for the improved Bloomery Furnace.

The drawings, Figs. 4, 5 & 6. Plate IV., represent an elevation, and vertical and horizontal sections, all drawn upon a scale of three feet to an inch, and the same letters refer to the corresponding parts of each.

A.—Trundle head where the furnace is charged; to be provided with a cover, which is placed on in the intervals of charging, when the coal is low.

B.—Projecting, open, hollow hearth, for the reception of cinder and iron, with a cinder hole at C, to be opened when it is wished to draw off the cinder.

DD.—Tuyeres, for the introduction of the blast, placed in different positions on three sides of the furnace, and at different elevations, to vary the direction of the blast at different stages of the process.

The back and front in-walls may both, or either, be thrown or inclined somewhat more inward than is represented in the drawing, and as indicated by the dotted lines in the vertical section; and with advantage when the ore is not very pure, and makes much cinder.

The furnace should have over it a brick canopy, or a chimney, to aid in giving a direction to the gas given out by the coal, which is distressing to the workmen if largely diffused immediately around it.

The furnace should be lined with fire brick, and cased with cast iron plates, secured by strong bolts, keys and screws, and, between the casing and lining, common brick with a thin packing of sand; the latter, to prevent injury from expansion.

B. B. HOWELL.

Notes on the foregoing.—In a letter from the patentee, which was received with his application, he observes, "I some time since men-

tioned to you, that I had then completed some further experiments with anthracite coal, the result of which I should soon communicate to you, and which I thought would both interest and surprise you. The papers which I enclose will explain what these experiments were. They relate to an improvement in the Bloomery furnace, and in the conversion of iron ore into malleable iron, with anthracite coal, exclusively. In this, in six different experiments, I completely succeeded, making, in a comparatively short time, perfect bar iron, and, indeed, nails, without suffering it ever to cool. Practical forgemen, who performed the manual labour, were astonished beyond measure, at the result: it was, indeed, complete in every respect, the iron being as good as that made at the neighbouring forges, in the old way.

"Refining of pig-iron, has been attempted in Pennsylvania, but, I believe, abandoned, from the difficulty of preventing a mixture of coal with the iron, in its soft state; this, in my method, is obviated, almost entirely. The process is rapid, and even here, where the coal is high, is economical; how much more must it be so, where coal, and ore, can be had for digging."

The editor has in his possession, a part of the bar, and a nail, forged directly, and without cooling, from the first bloom made in this way; he will seek for further information upon the progress of this improvement.

Manufacture of Diamonds.

At a recent meeting of the Academie des Sciences, a letter was read from M. Gannal, stating the result of his inquiries into the action of phosphorus, brought into contact with pure carburet of sulphur.

Having occasion to prepare a large quantity of carburet of sulphur, M. Gannal conceived the idea of endeavouring to separate the sulphur of this product, in order to obtain a pure carbon. Phosphorus was the material which he used; and he found that the phosphorus entering into combination with the sulphur, the carbon was set at liberty in the shape of small crystals, possessing all the properties of the diamond, and especially that of scratching the hardest bodies. The following is a detail of the experiment:—

If several rolls of phosphorus are introduced into a matrass containing carburet of sulphur, covered with a layer of water, the moment the phosphorus finds itself in contact with the carburet, it dissolves, and, becoming liquid, is precipitated to the lower part of the matrass. The whole mass is then divided into three distinct layers; the first formed of pure water, the second of carburet of sulphur, and the third of liquefied phosphorus. Things being in this state, if the matrass be agitated so as to cause the mixture of the different bodies, the liquor grows thick, becomes milky, and, after a little rest, separates anew, but only into two layers; the up-

per one of pure water, the under one of phosphuret of sulphur; and between those two layers, there is a very thin stratum of white powder, which, when the matrass is exposed to the sun's rays, exhibits all the colours of the prism; and which, consequently, appears to be formed of a multitude of little crystals.

Encouraged by this experiment, M. Gannal endeavoured, by the following process, to obtain larger crystals, and succeeded. He introduced into a matrass, placed where it would be quite undisturbed, first eight ounces of water, and then eight ounces of carburet of sulphur, and eight ounces of phosphorus. As in the preceding experiment, the phosphorus dissolved; and the three liquids arranged themselves in the order of their specific gravity. After four-and-twenty hours, there was formed between the layer of water and the layer of carburet of sulphur, an extremely thin pellicle of white powder, having here and there several air-bubbles, and various centres of crystallization, formed, some by spars of very thin sheets, and others by stars. In the course of a few days, this pellicle gradually grew thicker. At the same time, the separation of the two inferior liquids became less complete; and in three months they appeared to form but one and the same substance. Another month having elapsed without any new result, the question was, how to find means of separating the crystallized substance from the phosphuret of sulphur, to which the inflammability of the mixture presented great obstacles. After several attempts, more or less unsuccessful, M. Gannal determined to filter the whole through a chamois skin, which he afterwards placed under a glass bell, taking care, from time to time, to renew the air. At the end of a month, this skin becoming capable of being handled without inconvenience, it was doubled up, washed, and dried. For the first time, M. Gannal was then enabled to examine the crystallized substance which remained on its surface. Exposed to the sun's rays, this substance presented numerous crystals, reflecting all the colours of the rainbow. Twenty of them were large enough to be taken up with the point of a penknife; and three others were of the size of a grain of millet. These last, having been submitted to the inspection of an experienced jeweller in Paris, were pronounced by him to be real diamonds! A. M. Delatour states that he has, also, produced the diamond by a different process, of which a brief notice shall appear in our next. [*Lit. Gazette.*

Great Ship Canal of the Netherlands.

The object of the Great Canal, is, to afford a passage for large vessels from Amsterdam to the sea. This city has forty feet of water in the road in front of its port, but the Pampas, or bar in the Zuyder Zee, seven miles below, has only a depth of ten feet, and hence all ships of any considerable burden, have to unload part of their cargoes with lighters, before they enter the port. As the sea

in question is full of shallows throughout, all ordinary means of improving the access to the port, were necessarily ineffectual; and the resolution was, therefore, at length adopted, of cutting a canal from the town to the Helder, the northernmost point of the province of Holland. The distance between these extreme points is 41 English miles, but the length of the canal is about 50½. The breadth at the surface of the water, is 124½ English feet (120 Rhinland feet;) the breadth at bottom 36; the depth, 20 feet 9 inches. Like the Dutch canals, generally, its level is that of the high tides of the sea, from which it receives its supply of water. The only locks it requires, of course, are two tide locks at the extremities; but there are, besides, two sluices with flood-gates in the intermediate space. It has only eighteen bridges (draw-bridges) in its whole length. The locks and sluices are double, that is to say, there are two in the breadth of the canal; and we learn from Mr. Bald, that their construction and workmanship are excellent. They are built of brick for economy, but bands of lime-stone are interposed at intervals, and these project about an inch beyond the brick, to protect it from abrasion by the sides of the vessels. There is a broad towing-path on each side, and the canal is wide enough to admit of one frigate passing another. From the river Ye at Amsterdam, it proceeds north to Purmerend, thence west to Alkmaar Lake, thence north by Alkmaar to a point within two miles of the coast, near Petten, and it continues to run nearly parallel to the coast from this point to the Helder, where it joins the sea, at the fine harbour of Niewediep, formed within the last thirty years. At the latter place, there is a powerful steam engine for supplying the canal with water during neap tides, and other purposes. The time spent in tracking vessels from the Helder to Amsterdam, is eighteen hours. The Helder point is the only spot on the shores of Holland that has deep water; and it owes this advantage to the Island of Texel, opposite, which, by contracting the communication between the German Ocean and the Zuyder Zee, to a breadth of a mile, produces a current which scours and deepens the channel. Immediately opposite the Helder, there is 100 feet of water at high tides, and at the shallowest part of the bar to the westward, there are twenty-seven feet. In the same way, the artificial mound which runs into the lake or river Ye, opposite Amsterdam, by contracting the water-way to about 1000 feet, keeps a depth of forty feet in the port (at high water.) while above and below there is only ten or twelve. The canal was begun in 1819, and finished in 1825. The cost was estimated at ten or twelve millions of florins, or about one million sterling. If we compute the magnitude of this canal by the cubic contents of its bed, it is the greatest, we believe, in the world, unless some of the Chinese canals be exceptions. The volume of water which it contains when filled, or the *prism de remplissage*, is twice as great as that of the New York Canal, or the Canal of Languedoc, and two and a half times as great as that of the Caledonian Canal, if we include only those parts of the latter which have been cut with human labour.

[*Lond. New Monthly Mag.*

Franklin Institute.

A meeting of the board of managers was held at the hall, January 20, 1829.

James Ronaldson, president, in the chair.

The actuary read so much of the minutes of the annual meeting of the Institute, held the 15th inst. as related to the election of this board.

Whereupon, the board went into an election for chairman and curators for the ensuing year. Messrs. Samuel J. Robbins and Isaac B. Garrigues, were appointed tellers, who reported the following gentlemen duly elected, viz.

Henry Horn, Chairman,
George Fox, and
Thomas M'Euen, M. D. } Curators.

On motion, it was *Resolved*, that the stated meetings of this board be held on the second Thursday evening in every month.

The candidates proposed at the last meeting of the former board, were duly elected members of the Institute.

A stated meeting of the board of managers was held at the hall on Thursday, February 12, 1829.

Mr. Henry Horn, chairman.

The minutes of the last meeting were read and approved.

The chairman appointed the following standing committees, which were approved by the board, viz.

On Instruction.

George Fox,	Isaac Collins,
J. B. Garrigues,	Charles Wheeler,
Henry Horn,	C. D. Meigs, M. D.
Thomas M'Euen, M. D.	Charles Roberts,
Wm. Yardley, jr.	R. R. Lewis.

On the Library.

Isaac Hays, M. D.	Thomas Loud,
Charles H. White,	Frederick Fraley.
George Fox,	

On the Cabinet of Models.

Rufus Tyler,	Joseph H. Schreiner,
John Struthers,	Thomas Scattergood.
John O'Neill,	

On the Cabinet of Minerals.

Abraham Miller,	Thomas M'Euen, M. D.
Isaiah Lukens,	James Rowland, jr.
Isaac Hays, M. D.	

On Premiums and Exhibitions.

James Ronaldson,	Christian Gobrecht,
Adam Ramage,	Mathias W. Baldwin,
Isaiah Lukens,	Samuel J. Robbins,
Mordecai D. Lewis,	Algernon S. Roberts.

On Publications.

Samuel V. Merrick, Isaac Hays, M. D. Rufus Tyler, Isaiah Lukens, Mathias W. Baldwin.

On Inventions.

James Ronaldson, Mathias W. Baldwin, Christian Gobrecht, Isaiah Lukens, Andrew Young, Samuel V. Merrick, Benjamin Reeves.

Managers of the Sinking Fund.

Samuel V. Merrick,
Ashbel G. Ralston,
Samuel J. Robbins.

Auditors.

Abraham Miller,
Isaac B. Garrigues.

The special committee appointed by the late board, at the request of Mr. Isaac M'Cauley, to visit his floor cloth manufactory, presented a report, which was read, and on motion, the actuary was directed to furnish Mr. M'Cauley with a copy.

The corresponding secretary presented the following communications, viz. a work, entitled, "Du Développement, à donner à quelques parties principales et essentielles de notre Industrie Intérieure," from the author, M. de Moleon, Chief Engineer of the king's cabinet, and of the Royal Domains of France. And, also, a letter from the same, requesting to be elected a correspondent. A letter from M. Chersant, Vice Consul of France, enclosing the above, and offering to transmit any communications for the Institute.—A letter from the Franklin Institute of Rochester, New York, acknowledging the receipt of the Journal of the Franklin Institute, for the past year, and expressing a desire to continue the correspondence.

Whereupon, it was *Resolved*, that the corresponding secretary be instructed to forward the Journal of the Institute to that Institution, as published, and to continue the correspondence.

On motion, it was *Resolved*, that a committee be appointed to report to this board the design and expense of a diploma of membership, to be issued to the members of the Institution. Isaac Hays, M. D., and Messrs. Samuel V. Merrick and Thomas Loud were appointed said committee.

Resolved, that the above committee be instructed, also, to report the design of a certificate, to accompany the medals awarded at the exhibitions of the Institution.

Resolved, that a committee be appointed to report a plan for the monthly meetings of the Institution. Isaac Hays, M. D., and Messrs. Samuel V. Merrick and Rufus Tyler were appointed said committee.

Resolved, that a committee be appointed to have cases for the cabinets of minerals and models put in the meeting room. Isaac

Hays, M. D., Thomas M'Euen, M. D., and Mr. Isaiah Lukens, were appointed said committee.

Resolved, that the committee on premiums and exhibitions be instructed to prepare a list of premiums to be awarded at the next exhibition to be held by the Institute.

The election of members of the Institute, proposed at the last meeting, was called for, when M. de Moleon, of France, was duly elected a correspondent, and Dr. Thomas P. Jones, of Washington city, an honorary member, and the remaining candidates were elected members of the Institution. Extract from the minutes.

William Hamilton, *Actuary*.

Prevention of Forgery.

[From Silliman's Journal.]

Messrs. James Atwater and N. & S. S. Jocelyn, of this city, (New Haven,) have completed a plan to prevent forgeries and alterations of bank checks, drafts, bills of exchange, post notes, notes of hand, and other similar instruments.

The labour of carrying into effect such a design, may be, in some measure, understood, when it is considered, that to the accomplishment of a plan which shall obviate all the difficulties of the present mode of doing business, particularly by means of checks, the several following points should be compassed, viz.

Banks should be protected against losses arising from the depredations of swindlers, effected both by original forgeries and by alterations of genuine checks; and the characters of honest dealers, and tellers of banks, should be preserved from the unjust suspicions which may now, sometimes, arise from the impossibility of tracing a forgery to its origin. All these exposures exist in the present mode of transacting the business of banks, and the calamitous consequences too frequently arrest the public attention.

That these various objects can be embraced in one plan, within the ordinary limits of instruments of the kinds referred to, and yet admit of that simplicity and facility which the rapid transaction of business requires, is an idea, which, if it ever occurred to any person, was, probably, regarded only as something to be desired, but scarcely to be hoped for; and, consequently, the old and exposed method has continued in use, with all its temptations to the vicious and the unfortunate. It is believed that no attempts have been made hitherto, to accomplish more than one of these objects, and that with but doubtful success.

The inventors of the plan now spoken of (which they have secured by patent) claim to themselves the merit of conceiving and executing the whole combination of desiderata, and of removing all the obstacles which necessarily present themselves, in an attempt to establish a consistency in the union of so many important points. In the labour and experiments consequent on this undertaking, they have

spent more than an entire year; and the result, in the estimation of gentlemen connected with banking institutions, is such as to justify the opinion, that their efforts have been successful, and that the general adoption of this plan will secure the most desirable consequences. It is considered as original; and, in the opinion of the most competent judges, it certainly is so in its whole combination and effect, and in nearly all its details.

As regards the liability hitherto existing in all the instruments of the kinds above-mentioned, to successful alterations usually effected by the application of chemical agents, they have provided an effectual preventive, so that even signatures and sums may be altered, without its being possible for the swindler to avail himself of his fraud, without encountering a moral certainty of detection.

The frequency of frauds, and the prospect that they will continue to increase with the progress of population, business, and the arts, unless effectual efforts are made to oppose every obstacle to their growth, and, if possible, to remove every hope of success in the attempt, is a sufficient reason for pressing on the attention of the public, and, especially, of the officers of banks, a plan which promises to accomplish the desired object. We have critically examined the plan above proposed, and have seen it examined by skilful men of business, and by experienced officers of banks; and, if there is any mode of evading the effect of this ingenious and important invention, we confess we have not sufficient sagacity to discover it. [*Editor.*

Employment of Iodine as a Dye.

It appears from a note by Pelletier, that he ascertained, during a recent journey in England, that a large quantity of perioduret of mercury is sold in that country, under the name of English vermilion, which is employed principally in the preparation of paper hangings. Learning, also, that iodine was used in printing calico, he analyzed a specimen of the colouring material from Glasgow, and succeeded in forming a compound, which was a perfect imitation of the English salts. The proportions which he found to succeed best, were the following.

Hydriodate of potash, - - - - -	65
Iodate of potash, - - - - -	2
Ioduret of mercury, - - - - -	33
	100

This salt appeared to have cost, in England, one hundred francs the kilogramme (2 lb. 3 oz.) but could be prepared in France for thirty-six francs, reckoning the iodine to cost forty francs.

"It appears to me (observes this skilful chemist) that this salt ought to be applied to the stuff before it is passed through metallic solutions. Among the latter, those which give the most beautiful colours, are the solutions of lead and mercury. This salt may be

applied with advantage to stuffs, by the aid of a solution of starch, which becomes a beautiful violet, (a known effect of iodine and starch.) The starch appears, also, to contribute to fix the salt on the stuffs.

There is another salt, also, much employed, it is said, in Glasgow, in calico printing, which I ought, also, to mention, because it appears not to be much used in France. This is a triple acetate of lime and copper, prepared in the large way, by Ramsay, at Glasgow, for the printers. This salt is of a very beautiful blue. It crystallizes in straight prisms with square bases. The summits of the prisms are often replaced by facets, whence result prisms with six or eight planes, according to the extension which the secondary faces acquire.

When this salt is decomposed by a fixed alkali, the oxide of copper and lime are precipitated, combined, because they meet in the nascent state, and in definite proportions. It is certain that the precipitate turns green but little in the air, even in drying, and in its application, it is a kind of *ash blue*, which becomes fixed on the stuff. I call the attention of cotton printers to this salt, which may furnish very beautiful dyes, and which cannot become very expensive. [*Bulletin d'encouragement*, *Sept.* 1828.

Evaporation by means of Bladders.

M. SÆMMERING, in a memoir in the Academy of Sciences of Munich, states that alcohol, in a vessel covered with a bladder, the latter not being in contact with the fluid, loses, when exposed to a dry atmosphere, much of its water, and becomes stronger. But if the vessel thus closed, be exposed to a damp air, the alcohol attracts humidity and becomes weaker.

In a second memoir, the author states more particularly the effect of bringing the alcohol into immediate contact with the membrane. If a bladder be filled with 16 ounces of alcohol at 75°, and be well closed and suspended over a sand bath, or placed near a warm stove, so as to remain at the distance of more than an inch from the hot surface, it becomes, in a few days, reduced to a fourth of its volume, and is nearly, or quite, anhydrous.

M. Sæmmering prepares for this purpose, calves' or beeves' bladders, by steeping them first in water, washing, inflating, and cleansing them from grease and other extraneous matters, tying the ureters carefully, and then returning them to the water in order to clear off more fully the interior mucocity. After having inflated and dried the bladders, M. S. covers them with a solution of Ichthyocolla, one coating internally and two externally. The bladders thus become firmer, and the alcoholic concentration succeeds better.

It is better not to fill the bladder entirely, but to leave a small space empty. The bladder is not moist to the touch, and gives out no odour of alcohol. If the latter be below 16° Baume, the bladder then softens a little, and appears moist to the touch.

Bladders prepared as above, may be employed more than a hundred times, though they at length acquire a yellowish-brown colour, and become a little wrinkled and leathery. The swimming bladder of the salmon is not fit for these experiments. Alcohol of 72° was put into one of them, and after an exposure of thirty-two hours, it had lost more than one-third of its volume, and was weakened 12°. The alcoholic vapour was perceived by the smell.

Into two bladders of equal size was put, into one, eight ounces of water, and into the other, eight ounces of alcohol. They were placed side by side, exposed to a slight heat. In four days the water had entirely disappeared, while the alcohol had scarcely lost an ounce of its weight. Mineral waters, and that of wells, evaporate and deposit on the interior of bladders, the saline matters which they contain.

If the heat be conveniently managed, absolute alcohol may be obtained in six to twelve hours. Solar heat is even sufficient to produce anhydrous alcohol.

Wine placed in prepared bladders, contracts no bad odour; it assumes a deeper colour, acquires more aroma, and a milder taste, and becomes, generally, stronger. Spirits of turpentine of 75°, contained in a cylindrical glass closed with a bladder, lost nothing in four years. Concentrated vinegar, lost the half of its volume in four months, the other half acquired more consistency, and had no longer an acid taste. The water of orange flowers, was about one-third evaporated in a few months, appeared to have a stronger odour, and, consequently, had lost nothing of its volatile principle.

[*Ferussac's Bulletin, Mai,* 1828.

Method of Preserving Fruit without Sugar.

You must use wide-necked bottles, such as are used for wine and porter. Have the bottles perfectly clean. The fruit should not be too ripe. Fill the bottles as full as they will hold, so as to admit the cork going in. Make the fruit lie compact; fit the corks to each bottle, slightly putting them in that they may be taken out the easier when scalded enough; this may be done in any thing which is convenient; put a coarse cloth of any kind at the bottom of the vessel, to prevent the bottles from cracking; fill the vessel with water sufficiently high for the bottles to be nearly covered in it; turn them a little one side, to expel the air that is contained in the bottom of the bottle; then light the fire; take care that the bottles do not touch the sides nor the bottom of the vessel, for fear they will burst, and increase the heat gradually, until the thermometer rises to 160 or 170°. If such an instrument cannot be procured, you must judge by the finger; the water must not be so hot as to scald. It must be kept at that sufficient degree of heat for a half hour; it should not be kept on any longer, nor a greater heat produced than above-mentioned. During the time the bottles are increasing in heat, a tea-

kettle of water must be ready boiled, as soon as the fruit is done. As soon as the fruit is properly scalded, take the bottles out of the water one at a time, and fill them within an inch of the cork, with the boiling water. Cork them down immediately, doing it gently, but very tight, by pushing the cork in, for agitation will be apt to burst the bottles; lay the bottles on the side, to keep the air from escaping. You must take care to let them lie on their sides until wanted, often turning them over, once in a week, or once in a month. [*Silliman's Journ.*

Fine Red Colour from Walnuts.

A chemist of Brussels, who was recently washing his hands, which were stained with walnuts, in some water which was impregnated with chlorurite of lime, found, to his surprise, that the water became beautifully red. He repeated the experiment, and concludes from it that the colour produced by the mixture of the rind of the walnut with the chlorurite, may be rendered useful to the arts. [*Register of Arts.*

To Preserve Iron from Rust.

We do not know any thing more convenient, and at the same time as cleanly and permanent, as a little bees' wax brushed over the articles. A solution of caoutchouc in five times its weight of oil of turpentine, and this solution dissolved in eight times its weight of drying linseed oil, which forms the varnish of air-balloons, is much recommended. Grease, oils, tallow, &c. are filthy applications, soiling every thing that comes in contact with them; and from the acids and water contained in them, they, after a time, corrode the metal they were intended to protect. There is a method adopted in manufactories, of steeping bright iron articles in lime water, which preserves them for a considerable time against corrosion: our chemists might, perhaps, avail themselves of this hint to prepare some good composition for preserving this most valuable of the metals. [*Ib.*

LIST OF ENGLISH PATENTS.

List of Patents which passed the Great Seal, from August 28th to September 25th, 1828.

To George Stratton, gentleman, for his inventing an improvement in warming and ventilating churches, hot-houses, and all other buildings, which improvements may be applied to other purposes—August 28.

To Granville Sharp Pattison, Esq. in consequence of a communication from a foreigner residing abroad, of a new and improved me-

thod of applying iron in the sheathing of ships and other vessels, and of applying iron bolts, spikes, nails, pintals, braces, and other fastenings, used in the construction of ships and other vessels—September 4.

To John Seaward and Samuel Seaward, Engineers, for their having invented a new and improved method or methods for propelling or moving carriages and all other vehicles on roads, and also ships, boats, and other vessels on water—September 4.

To Charles Sanderson, Iron Master, for his having invented a new method of making shear steel—September 4.

To Samuel Brooking, Esq. a rear admiral in the Royal Navy, for his invention of a new method or mode of making sails of ships and other vessels—September 4.

To John Robertson, Rope Manufacturer, for his invention of certain improvements in the manufacture of hempen rope or cordage—September 4.

To William Bell, gentleman, for his having invented improved methods for filtrating water and various other liquors—September 4.

To William Farish, Jacksonian Professor in the University, for his having invented an improved method or methods of clearing out water-courses—September 4.

To Thomas Robinson Williams, for his having invented or found out certain improvements in the making of hats, bonnets, and caps, and in the covering of them with silk and other materials, with the assistance of machinery—September 11.

To Thomas Milikew, Cabinet Maker, for his having invented or found out an improvement in the construction, making, or manufacturing of chairs, sofas, lounges, beds, and all other articles of furniture, for similar purposes, and also of travelling and other carriages and vehicles of every description, for personal use—September 11.

To James Beaumont Neilson, Engineer, for his having invented and found out an invention for the improved application of air to produce heat in fire forges and furnaces, where bellows, or other blowing apparatus, are required—September 11.

To Lemuel Wellman Wright, Engineer, for his having invented certain improvements in machinery for making screws—September 18.

To William Losh, Esq. for his invention of certain improvements in the formations of iron rails for rail-roads, and of the chairs or pedestals, in or upon which the rails may be placed or fixed—September 18.

To Joseph Rhodes, the younger, Worsted Spinner, for his having invented certain improvements in machinery for spinning and twisting worsted yarn, and other fibrous substances—September 18.

To Joseph Clisild Daniell, Clothier, for his having invented improvements in the machinery used for dressing woollen cloth—September 18.

To John Melville, Esq. for his having invented certain improvements in propelling vessels—September 18.

To Edward Forbes Ocson, gentleman, for his having invented an improved cartridge for sporting purposes—September 18.

To John Jones, Brush Maker, for certain improvements in machinery, or apparatus, for pressing and finishing woollen cloth—September 25.

LIST OF FRENCH PATENTS.

Granted in the last quarter of the year 1827.

(Concluded from p. 80.)

To Clement Desormes, of Paris, for a new construction of rooms destined to the manufacturing of sulphuric acid—15 years.

To Migeon of Morvillars, for a machine to form the heads of wood screws by heat—10 years.

To Delacoux, of Paris, for an improved harp—10 years.

To Choel nec Marie, Marquerite Leger, of Paris, for a method to cut out the edges of bobbin net—5 years.

To Adam Jacques Francois, of Paris, for a moveable binding of books—10 years.

To Bertaux Alexandre Murie, of Paris, for means to prevent the oversetting of carriages—10 years.

To Thinat of Nantes, for a new high pressure steam engine—10 years.

To Lamothe Jean, of Montreal, to make Bagliamy's distilling apparatus portable—10 years.

To Strylosh William, of Lyon, for a process of manufacturing tallow candles imitating wax candles—5 years.

To Beauduin Vramenne Servais Joseph, of Sedan, for a machine to prepare any material destined to the selvage of cloth—10 years.

To Perkins, Jacob, a citizen of the United States, for improvements in steam engines—15 years.

To Becasse Pierre Victor, of Paris, for a carriage trigger with a moveable lever—5 years.

To Bernhard Antoine, of Berlin, for an apparatus to raise water or any other fluid, by the pressure of the atmosphere only—15 years.

To Galy-Cazalat, of Nancy, for an acrostatic lamp, and candlestick—10 years.

To Chamboredon Louis Cesar, of Alais, for a mechanical power, he calls "conservateur des forces"—5 years.

To Wright Lemuel Wellman, of London, for a new improved crane—15 years.

To Gourlier, Adrien Jean Baptiste, of Paris, for a boot iron he calls "fer mobile cylindrique"—5 years.

To Petit Pierre Jean Henri, for a machine he calls typomelographique, for engraving music—5 years.

To Boche and Aubin, for a box for measuring the charge of gunpowder—5 years.

To Rolle Frederic and Schivilque Jean Baptiste, for a scale to weigh carriages—10 years.

To Niogret Guillaume, of Paris, for a method of carrying passengers and goods without the power of horses, steam, &c.—10 years.

To Capy, of Paris, for a coffee-pot—5 years.

To Chamblant, Marie Nicolas Joseph, of Paris, for a new mechanical principle to convert the direct into a rotary motion—15 years.

To Vicomte de Barres du Molard Jean Scipion Henri, of Paris, for a new system of bridges with expanded bearings—15 years.

To Duclose Philippe Ignace, of Paris, for a girdle he calls "menouheene," for the use of females—5 years.

To Bostock, James Bethune, of London, for a system of machinery to manufacture metallic screws, commonly called "wood screws"—15 years.

To Duguet, junr. Antoine Nicolas, of Paris, for a machine he calls "petrin mechanique," for making bread—15 years.

To Batilliat Pierre, of Macon, for a chemical substance to substitute for linen rags, in the manufacture of paper—10 years.

To Gervais, of Paris, for a process to improve the manufacturing of wines, brandy, and other spirits—10 years.

To Gibon Jacques Louis, of Paris, for new unalterable picture frames—5 years.

To Poupon Claude, of Nuits, for a wine press—5 years.

To Nuellens, of Paris, for elastic matrasses, &c.—15 years.

To Arnett Thomas, of London, for an improved floating bed—10 years.

To Perkins, Jacob, a citizen of the United States, for additional improvement in steam engines—15 years.

To Moitenier Antoine Prosper Marchand Auguste and Mazeline Jaques Francois, for a cloth shearing machine, called "velocifor"—5 years.

To Fusz Pierre, of Isming, for a mechanical coach trigger, to stop the wheels of carriages—10 years.

To Delaporte Pierre and Berthier, Jerome, for a process to manufacture metal thimbles—5 years.

To Aschermann and Perrin, of Paris, for a blowing machine to cleanse the materials employed in the manufacturing of hats—10 years.

To Capelain, Jean Baptiste Claude, of Rouen, for a cloth shearing machine he calls "mouvement alternatif"—5 years.

Queries.—A subscriber wishes to be informed, through the medium of this Journal, of the best mechanical method for raising water from a well 50 feet deep, for common domestic and culinary purposes.

How many inches of water, under a 15 feet fall, will produce the same effect as 100 inches under a 20 feet fall, both acting on overshot wheels, under a 3 feet head?

Suppose 100 inches of water of 20 feet 6 inches fall, be received at 600 dollars per annum, what will be the value of 100 inches, the fall being 9 feet 8 inches, the situations being otherwise equal?

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania;

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

MARCH, 1829.

Observations on the connexion of Mechanical Skill, with the highest attainments in Science; being the substance of a lecture introductory to a course of Mechanics; delivered to the Franklin Institute, by the Editor, *January 24th*, 1826.

Without attempting to exhibit a scale of the relative excellence of associations, formed under the united influence of patriotism and benevolence, we may claim for our own a high station, and need not fear that our claims will be disputed. In its purview, it embraces one of the largest classes of men in every civilized community, a class upon whose operations is founded almost every thing which distinguishes a state of culture from barbarism, the philosopher from the savage.

To recount the operations of the mechanic, and to exhibit them as they contribute to the blessings of existence, would require the life of an antediluvian; excepting the products of nature in their unaltered state, every object upon which we can turn our eyes in the habitations of man, would present a subject for dissertation; a nail, or a pin, would furnish us with materials for a history; a history, in which its origin and progress would, in general, like that of nations, be found to defy the researches of the most industrious.

It has been imagined by some philosophers, that the first efforts of man in the arts were imitative, having been suggested by those of the brute creation. "It may be true," says lord Monbaddo, "that man first learned to build from the swallow, from the spider to weave, and from the birds to sing:" his lordship, however, was remarkable for a creative fancy, as is evinced by his imagining, in

one of his philosophical dreams, that, in the ourang-outang, we might discover our own progenitors. Mr. Pope in his Essay on Man, has presented us with a similar idea respecting the origin of the arts, where he says,

> "Go, from the creatures thy instruction take;
> Learn from the birds, what food the thickets yield;
> Learn from the beasts, the physic of the field;
> Thy arts of building, from the bee receive;
> Learn of the mole, to plough, the worm, to weave;
> Learn of the little nautilus, to sail,
> Spread the thin oar, and catch the driving gale."

The philosophy of the poet, and the poetry of the philosopher, are assuredly contradicted by observation and experience; those seem plainly to indicate that the common adage, which says that "necessity is the mother of invention," is a truism, which is felt and exemplified in the experience of every man, and in almost every hour of his life. In the earliest stages of society, the inclemency of the weather must have suggested the necessity of a shelter; the vicissitudes of the seasons, the use of some kind of covering for the body; and the employments of the chase, the formation of instruments for attack and defence.

Many of the arts, undoubtedly, originated in accident; the smelting of ores, the formation of glass, and the manufacture of pottery, were, probably, of the number. Whenever man had acquired a knowledge of the use of fire, its effects upon certain kinds of clay, exposed to its action, must soon have attracted notice; and an article so easily moulded into any form, could scarcely fail of being brought into use. The making of earthenware, probably, preceded the discovery of the metals, as it could be formed without their aid.

The art of working some of the metals, appears to have preceded the deluge; we could not, indeed, imagine such a vessel as the ark to have been built without their use. The metals first known, were, probably, found native; in which state they frequently exist on, or near, the surface of the ground, beneath which beds of ore are deposited. The accidental employment of fire in contact with some of their ores, was very likely to suggest the method of reducing them to the metallic state. In conformity with this idea, it has been asserted, that iron was discovered at an early period of Grecian history, by the burning of the forests of Mount Ida; and the knowledge of the silver mines of the Pyrennees, is attributed to a similar cause.

According to Pliny, the formation of glass, by the union of sand with the mineral alkali, was an accidental discovery. It is said that a vessel, loaded with the latter article, was cast on shore, and that the fires made by the mariners on the sand, caused the fusion of the alkali, and the earth, and thus produced glass; the hint thus given was pursued, and the useful and beautiful material became an article of manufacture.

It is not my intention in the present lecture, to pursue the inquiry into the origin of the useful arts, but to give to my observations a

more certain and practical direction, by noticing their application in the highest attainments of science. It is to the skill of the artisan that we are indebted for those accurate observations, which have made us so intimately acquainted with the mechanism of the heavens; and which have enabled us, practically, to solve that long propounded problem, the discovering of the longitude at sea. The history of the progress of astronomy, and of the improvements in navigation, would, also, be a history of the progress of mechanical skill; and, indeed, our most distinguished mechanics have become so, in consequence of their acquaintance with scientific principles; and our most distinguished philosophers have been, also, remarkable for their mechanical genius. A few examples will prove the correctness of these observations.

It was not until the year 1725, that any instrument was possessed by the astronomer which was worthy of particular notice, on account of its accuracy; at this period, a mural quadrant was made by Graham, a celebrated and scientific clock and watchmaker, in London; this instrument, made for the royal observatory, was unique in its kind, and still exists, a monument of the skill of the artist, who not only availed himself of the contrivances of his predecessors, but manifested his extraordinary genius, by inventing new methods for giving to his work that permanence, and accuracy, upon which its value depended.

In a few years after this, a self-taught artist of the name of Bird, became an able competitor of Graham. Bird was bred a weaver, and was led to turn his attention to the division of circles, by observing a common clock, upon the face of which the minutes were not accurately divided. Pursuing a happy train of thought on this subject, he was soon convinced that he had detected the causes of the errors in the methods which had been followed, and had discovered the means of correcting them; and although he went to London, unknowing and unknown, he was, in the course of a few years, reputably established as a mathematical instrument maker. These two artists, Graham and Bird, continued for many years, not only to supply instruments for their own country, but the philosophers of France, and the governments of many other countries acknowledged their superiority, by obtaining them for their surveys and observatories. Some idea of the excellence of their instruments may be formed, from the fact, that by them, the error in the going of a clock was ascertained to the fifth part of a second, nine observations out of twelve not differing more than one-tenth of a second from the mean result. So largely is astronomy indebted to these instruments, and to others since made, with many improvements by Ramsden and Throughton, that it is acknowledged that the single observatory, at Greenwich, has done more for the improvement of astronomy, than all the other observatories of Europe taken together. Baron De Zach, speaking upon this subject, observes, "if any one should assert that our astronomical tables would be equally perfect, if the other *hundred and thirty* European observa-

tories had never existed, he would be very well able to support his assertion."

Whilst the mechanic has thus given value to the observations of the astronomer, enabling him, by his accurate divisions of space, to ascertain the positions of the heavenly bodies, within the $\frac{1}{3600}$ part of a degree, navigation has derived equal advantages, from the perfection with which chronometers, or instruments for marking the divisions of time, have also been made. We cannot now trace their history, but will cite an example of their surprising accuracy. Four time keepers, of this kind, made by Parkinson and Frodsham, of London, were taken by Capt. Parry to the polar regions, where they were exposed to a degree of cold 87° below the freezing point; upon his return, after an absence of 18 months, the greatest error was only 7 seconds in time; and the mean error of the whole four, under two seconds; these, therefore, must have enabled them to discover their longitude, within a few hundred yards, leaving nothing further to be desired in this particular.

Newton, whose name is associated in our minds with every thing that is great and excellent in science generally, but particularly in astronomy, delighted, in early life, in mechanical pursuits. "It is recorded of him, that while at school, his thoughts ran more on practical mechanics, than on his regular exercises; and that during those hours of recreation, which the other boys devoted to play, he was busy with hammers, saws, and hatchets, constructing miniature models, and machines of wood. Among his first efforts was a wooden clock, kept in motion by water, and telling the hours on a dial plate at the top. He made kites, to which were attached paper lanterns, and one of his favourite amusements, was, flying them in the night, to the consternation of the neighbouring inhabitants. He fabricated tables, and other articles of furniture, for his schoolfellows, and is said to have invented and executed, a vehicle with four wheels, on which he could transport himself from one place to another, by turning a windlass."

After he had completed his collegiate studies, was ardently engaged in his experiments on light and colours, and had commenced his observations on the heavenly bodies, he employed himself in various attempts to improve the telescope, and ground a great number of lenses, inventing a variety of methods for giving to them the forms which he desired, and by which he expected to remove the imperfections of that instrument; when foiled in this attempt, he had recourse to the principle of reflection, and with his own hands, manufactured two reflecting telescopes, the first of which is still in the possession of the Royal Society. To polish the metallic mirror, is, even at the present day, an operation successfully performed by very few mechanics; yet this, Newton accomplished in the most perfect manner, and the method which he invented, of giving the highest polish without injury to the perfection of the surface, by finishing, on a tool covered with pitch, was one of those happy thoughts which are born of superior genius alone. This method is still followed, nor is it likely that another, equally good, will ever be devised.

James Ferguson, who from a very humble station in life, became, by his genius, and industry, a practical philosopher of distinguished reputation, first attracted attention, when only 7 or 8 years of age, by constructing machines to illustrate the properties of some of the mechanical powers, of which he imagined himself to be the inventor; he made a wooden clock which is said to have kept tolerable time. Having seen the description of a globe, in a book borrowed from a neighbour, he constructed one of sufficient accuracy to enable him to work all the ordinary problems. He attempted to make a watch, with wheels of wood, and a whalebone spring, having no other intimation of its structure, than that obtained from a gentleman who was passing along the road near the house of his father, and who, observing his anxious curiosity, showed him the inside of his watch, and explained to him the principle upon which the spring gave it motion. Notwithstanding the materials of which young Ferguson's watch was constructed, were too rude to allow it to go, it served to prove his extraordinary patience and skill. Although he is not entitled to rank as a first rate genius, he became a distinguished lecturer on astronomy and natural philosophy, and was for some time the instructer of the late king of England, on those subjects. He published many works, which are still esteemed for a peculiarly familiar and perspicuous style, derived in a great degree from his skill in mechanics, which he happily applied to the illustration of philosophical principles.

We have already remarked, that Sir Isaac Newton was led to the invention of the reflecting telescope, from the difficulties which presented themselves in his endeavours to remove the defects of the refracting telescope. Many attempts were subsequently made by other philosophers with the same view; but the honour of complete success was reserved for Mr. John Dolland, who has immortalized his name by the invention of the achromatic telescope. Dolland was the son of a weaver in London, and in the early part of his life worked at the loom; but his mind was given to the pursuit of the mathematics and natural philosophy, and all his leisure hours were devoted to study, or to the construction of sun dials, and other instruments of science. By great industry, and by abridging the ordinary periods of repose, he acquired a considerable stock of general learning, became a practical optician, and commenced the business of manufacturing instruments: he introduced many improvements in their construction, and has, probably, brought the refracting telescope to the highest possible degree of perfection. His success in business was equal to his merits; his name was enrolled among those of the most distinguished philosophers in several learned societies; he was appointed optician to the king; and was as highly respected for his moral worth, as he was admired and honoured for his genius and talents.

Sir William Herschell was by profession a musician, but being passionately fond of the sciences of optics and astronomy, in order the more fully to pursue these subjects, he attentively studied the theory, and busied himself in the practice of mechanics; particularly

in the grinding and polishing of lenses and reflectors, for telescopes, and other apparatus applicable to astronomical observations. Such was his industry, that with his own hands he ground and polished more than 400 speculæ; some of them of extraordinary size; and although in the nice operation of casting them of such dimensions as had not, heretofore, been attempted, he encountered numerous difficulties, and suffered many severe disappointments, he persevered with unabated zeal, and in the year 1781, by the aid of one of his own telescopes, discovered the planet which now generally bears his name. This event rewarded him for all his past labours, and stimulated him to fresh exertions. The attention of Europe was turned towards him, his sovereign allowed him an annuity, and in a few years after, he finished his telescope of 40 feet in length, and nearly 15 feet in circumference, with a reflector 49 inches in diameter, which, when cast, weighed 2118 lbs. This immense tube of sheet-iron, with its ponderous appurtenances, he suspended with great mechanical ingenuity, so that it can with facility be directed towards any part of the heavens.

He was enabled by this instrument, which far surpassed all others in power, to enrich astronomy with numerous discoveries and observations, enlarging the boundaries of science, increasing his own fame, and augmenting the glory of his country.

One of the most striking examples of what may be accomplished by a powerful mind, unaided by the advantages of education, but dependant solely on the resources of an extraordinary genius, in which intuition seems to outstrip the march of science, is exhibited in the life of James Brindley. His education had been neglected in consequence of the imprudence of his father, and he was compelled to perform that kind of labour which falls to the lot of the poorer class, until he was 17 years of age. He then bound himself apprentice to a mill-wright, and at a very early period of his service, became the instructer of his master, and was preferred to him by his employers, when any thing was to be performed which was new, or difficult. Whatever he undertook, he accomplished; leaving on all his works the evidences of his superiority, in the improvements which he introduced. At the period when his skill, as a mechanic and engineer, had become extensively known, no canals of any great extent, or importance, had been constructed in England. About the year 1758, the duke of Bridgewater was desirous of extending one from the coal mines on his estates, to Manchester, about seven miles distant, and which, if accomplished, must be carried over rivers and deep vallies, and through subterraneous tunnels. Brindley surveyed the ground, and declared the work practicable; and although assailed by ridicule on almost every side, such was the duke's confidence in the talents of his adviser, that he determined upon its execution. When the canal had been completed as far as the river Irewell, (which is navigable for large vessels) and Brindley proposed to cross it by an aqueduct, elevated 39 feet above the surface of the water, an eminent engineer who was consulted on the occasion, observed, that he had "heard of castles in the air, but had

never before been shown where any of them were to be erected." In ten months after this, the aqueduct was completed, and the first boat passed through this air-built castle, whilst the vessels in the river pursued their ordinary course. The accomplishment of this undertaking established the credit of Brindley on an immoveable basis; the duke extended his canal to Liverpool, and the success of his efforts caused many others to be immediately planned. In the execution of these, the services of Brindley were anxiously sought for, and always rendered with the same results which had accompanied him in his former works.

When difficulties occurred which he could not readily overcome, he neither resorted to books, or to the labour of others; but retiring to his bed, secluded himself completely, until his plans were matured; and when his own mind was satisfied, success appeared to follow as a thing of course. He never, for his own use, drew any of his plans on paper, but made the most abstruse calculations in his mind, arranged all the parts of his most complex machines, and retained the whole in his memory, which his habits had rendered vigorous, to a surprising degree. He died in his 56th year, leaving behind him a character for integrity, as spotless as his genius was great; having accomplished more during the time of the comparatively short period which he devoted to internal improvements, than would have appeared possible, but for the testimony of his works.

[TO BE CONTINUED.]

ENGLISH PATENTS.

Specification of the patent granted to Benjamin Cook, *for a certain Mixture or Preparation, which may be used with advantage, in preventing the danger of accidents from Fire.* Dated April 16, 1822.

I the said Benjamin Cook, do describe and ascertain the nature of my said invention, and in what manner the same is to be performed; that is to say: I render all sorts of timbers, calicoes, cottons, silks, muslins, cloth, and linen of every description, incombustible, by the use of a mixture, or preparation, and thereby prevent accidents from fire; (namely) I take the two fixed alkalies, which I dissolve in water, in such proportions as I find necessary; if I require a very strong solution, I give to the alkali such quantity of soft water as it will take up to render it liquid, and of a consistency suitable for my purpose; such, for instance, as saturating of timber for most uses. I prefer the pure fixed vegetable alkali, which I disengage from its impurities, and then dissolve it in soft water, and by this plan I obtain a solution suitable for rendering calico, cottons, muslins, silks, cloths, and linen of every description, incombustible. The strongest solution which I can obtain from the pure

fixed vegetable alkali, is what I prefer for rendering timbers incombustible. Into this solution I put all timbers in the plank, in which situation they must lie till the alkaline solution has penetrated through the plank; a few weeks will generally effectuate this. I prefer using a very strong solution, but a much weaker one will render timber incombustible; that is to say, to every one hundred weight of alkali put twenty-five gallons of water; the strength of the solution I vary as I find needful, and according to what it is applied.

If I wish to render scenes of theatres, floors of rooms, or any other wood-work incombustible with a strong solution, I pass over every part with a brush four or six times, letting it dry between each time, when the pores of the timber will become saturated with the alkali, or the surface of the thing so passed over will be covered with the alkali, and prevent any accident from fire; but, for ship timbers, and, indeed, all timbers upon a large scale, I would saturate the tree with alkali at once, as it is fallen, and before it is barked, by means of an engine to extract or force out the sap; then to saturate the whole by forcing the alkali through all the pores of the tree, after which, it may be barked and sawed up into planks when required. All parts of vessels already built, if regularly washed and saturated with a strong alkaline solution, as herein set forth, will be rendered perfectly incombustible, so that ships at a very small expense may be preserved from the possibility of being injured by fire, either accidental or intentional. For rendering all sorts of calicoes, cottons, silks, muslins, cloth, and linens of every kind, incombustible, I make a weak solution of the vegetable alkali in the purest state I can obtain it, and as alkali produced from some vegetables is stronger than others, the simple mode I adopt, is, to keep adding alkali to the water until cotton, paper, or linen, dipped into it and dried, will not blaze; it will char by intense heat, but not inflame; for calicoes, cottons, silks, muslins, cloths, and linen, I prefer the solution as weak as it will allow, to prevent inflammability; but this solution, after it is made, should stand for a week or more, that all the impurity possible may settle at the bottom; it should then be drawn off into a clear earthen vessel, and again be suffered to stand for a month or six weeks, corked up in a heat nearly sufficient to produce evaporation, occasionally trying its purity by putting a portion of it into a clean flint-glass bottle holding about a pint, in order to ascertain by its clearness when it is fit for use. Before it is quite clear and proper for use, there will, generally, appear in it very thin transparent laminæ floating about, which will gradually sink to the bottom, leaving the solution as clear as the purest water, so as not to discolour the finest linen; it is then in a proper state ready to draw off into clean vessels for use. The articles to be rendered incombustible, such as wearing-apparel, bed-furniture, window-curtains, or any other articles made of cotton, linen, silk, muslin, or cloth, should, after they are washed and wrung as dry as can be out of the last water, be dipped into the solution and wrung out as dry as possible, then dried and ironed, or mangled in the usual way.

In my patent I claim the exclusive privilege for the application of the fixed alkalies in a mixture or preparation, which will prevent the danger of accidents by fire; but I here wish to remark, that while I render timbers incombustible, by extracting the sap, and saturating or filling up the pores with alkali, such timbers are not only rendered incombustible, but are also preserved from the dry-rot, as no timber so prepared will be affected by dry-rot. To the navy, and all public and private buildings, this is most important.

There are thus three great principles in the application of my discovery, of which I claim the exclusive privilege;

First, the application of the fixed alkaline solution in preventing all accidents from fire to calicoes, cottons, silks, muslins, cloth, and linen of every description, bed and window-curtains, and sail-cloths;

Secondly, its application to prevent, effectually, all wood-work of all sorts, either in buildings or vessels, of any description, from being destroyed by fire, either by accident or intention;—and,

Thirdly, the process used to render timber incombustible, will, at the same time, completely prevent the dry-rot from ever affecting such timber so prepared under my patent.

Specification of the patent granted to Robert Ford, *Chemist, for a Chemical Liquid, or Solution of Annotto.* Dated April 24, 1822.

To make twenty gallons of the chemical liquid, or solution of annotto, I take fifty-six pounds of annotto, more or less. I reduce it with warm water. Then I pass it through a fine sieve: let it stand seven days, or longer. Then I add the leys of subcarbonated potash; a sufficient quantity to produce the colour required. The quantity, and, also, the strength, must depend on the colour it is intended to produce, and, also, on the quality of annotto. (Other suitable articles may be used for this purpose.) Then I add to the above about six pints of the aqua lixivium caustic, more or less. Then I take alcohol, one hundred and ninety-two ounces, and mix the whole together, keeping it in a closed vessel.

I further declare, that as my invention consists in producing a liquid or solution of annotto, an article I believe to be entirely new, I shall consider any similar production, whether from different articles, or variation of quantity of the aforesaid articles, or by what means they are produced, as an infringement on my patent-right, as every chemist must be aware that there are ingredients other than those mentioned above, which may with effect be made to supply their, or either of their places.

Specification of the patent granted to John Bourdieu, Esq. *for a Discovery and Preparation of a Mucilage, or thickening matter, to be used in Printing or Colouring Linen, Woollen, and Cotton Cloths, and Silks, in cases in which Gums, Mucilages, or other thickening matters are now employed. Communicated to him by a foreigner residing abroad. April* 29, 1823.

I the said John Bourdieu, do hereby declare that the nature of the said invention, and the manner in which the same is to be performed, are particularly described and ascertained, in and by the following description thereof; that is to say: the mucilage or thickening matter to be used in printing or colouring linen, woollen, and cotton cloths, and silks, in cases in which gums, mucilages, and other thickening matters are now employed, is made from the grain or seed which is found in the fruit or pod of the tree, called in English, "carob tree," or "Saint John's bread;" in French, "Caronbier." This grain or seed may be used in any manner by which its mucilaginous parts or properties can be applied in the operations of printing and colouring above referred to. The mode which the person who informed me of the discovery thinks is best adapted to this end, is as follows: when the fruit or pod of this tree is ripe, the grain or seed is to be taken out of it by cutting, thrashing, friction, or by a mill, or in any other manner which may be found convenient. The seed when separated from the fruit or pod, is to be cleansed from the pulp or flesh which may adhere to it; this may be done by washing, drying, scraping, or friction, or in any other manner which may be found convenient. The seed is to be very finely pulverized by any process adequate to effect the operation; it may be done by the pestle and mortar, or by a mill, or by the methods used in the pulverization of drugs and substances of a hard nature, for medicinal or chemical purposes. As the pellicle, or skin, forms about one-tenth part of each seed, and is not mucilaginous, it will be desirable that the seed should be divested of it before the operation of pulverizing is commenced. The method to be pursued to get rid of the pellicle or skin, is to steep the grain in sulphuric or other corrosive acid, till the pellicle or skin is so carbonized that it will slip off or leave the seed; this usually takes place, in good sulphuric acid, in about six hours, and the effect of the process may be judged of by taking out from the acid some of the grains, from time to time, in order to find whether the destruction of the pellicle is completed; this may be ascertained by immersing some of the seeds in water, and then rubbing them between the thumb and fingers. When the pellicle is sufficiently carbonized or destroyed, the seed is to be taken out of the sulphuric acid and washed in water, and then the skin will be easily got rid of by stirring it about in the water, or the seed may be dried and then rubbed in cloths, or shaken in sacks or sieves; by either method the skin will be removed. The seed must be dried before the operation of pulverizing commences. The carob

seed, when reduced to a fine powder, is to be used in the various operations of printing and colouring linen, woollen, and cotton cloths, and silks, in the same manner as flour and starch are now respectively mixed, and used as thickening matter in such operations, with this difference, that the carob seed should be kept in a boiling state with the liquid to be thickened, for a space of from thirty to forty minutes, according to the heat of the fire. The quantity of carob seed which is necessary for each operation, is to be regulated according to the degree of consistence which may be required; the quantity will be different, according to the different mordants, and the different modes of impression or colouring to which it is to be applied. The workman must, according to the work to be done, ascertain the degree of consistence required to be produced by the carob seed, in the same manner as the degree of consistence required to be produced by gum Senegal, or other thickening matters, is now ascertained; and it is necessary to observe, that in all cases in which carob seed is used, without having been first divested of its pellicle or skin, whether applied as a substitute for gum or for other thickening matters, the mordants and colours prepared with carob seed ought to be of rather a thicker consistence than would be requisite for a mordant or colour for a similar operation, when such mordant or colour is thickened by or used with gum Senegal; but when used after the pellicle or skin has been removed, its consistence must be the same as when such mordants or colours are thickened by, or used with, gum Senegal. In general, it will be found, that when the pellicle is not removed, one pound of carob seed should be used, where about eight pounds, or from eight to about nine pounds of gum Senegal are now required. In cases where the pellicle or skin has been detached from the carob seed, about one pound of carob seed should be used, where about nine pounds, or from nine to ten pounds of gum Senegal are now required.

On giving Magnetic Power to Iron or Steel, and on completely freeing those Substances from Magnetism, by hammering them while in certain positions. Abridged from the Edinburgh Philosophical Journal.

Dr. Gilbert, two hundred years ago, discovered that iron made red hot, and then drawn out by hammering, while placed in the magnetic meridian, became magnetical. Mr. Scoresby has ascertained that a horizontal position in the magnetic meridian was by no means the best position for the development of magnetism by percussion; but that the position of the dipping-needle given to bars of iron, when hammered, produced the highest effect. A single blow with a hammer on a bar of soft iron, held vertically, was found to be capable of giving it a strong magnetic action on the compass, the upper end becoming a south pole, and the lower end a north pole: on inverting the bar, another blow was found sufficient to change

the polarity formerly given to it. But one of the most important effects of percussion observed by Mr. Scoresby, was found to be this, that a blow struck upon any part of a bar of iron, while held in the plane of the magnetic equator (which is horizontal E. and W., or with the north end elevated about 19 degrees above the horizontal line in this country,) has an invariable tendency to *destroy* its magnetic action, which it generally does so effectually as to prevent its exerting any influence over a compass, when presented to it in the same plane of the magnetic equator.

Previously, no other method was known of freeing iron or steel completely from magnetism, but that of heating it red hot, and allowing it to cool in a horizontal position, east and west. This process, however, besides spoiling the surface of the metal, is troublesome, and seldom completely effectual in its application. But the same object is accomplished in a moment, and with infinitely better effect, by Mr. Scoresby's process, merely by a slight blow or two with a hammer, while the iron or steel is held in the magnetic plane, and is equally applicable to very large and heavy bars. Grinding, filing, polishing, drilling, turning, twisting, bending, &c. were all found to elicit magnetic attraction, when performed in a vertical position, or any position out of the magnetic plane; but the same processes were destructive of polarity, when performed on a bar or plate of untempered metal, while held in the plane of the magnetic equator. Hence, the magnetism of steel chronometer balances would, no doubt, be prevented, and even destroyed, if they had previously obtained it, by turning them into form, and polishing them in the plane of the magnetic equator.

Mr. Scoresby found that soft steel received the greatest degree of magnetic energy by percussion. In soft iron, the magnetism was strong, but evanescent; in hard steel and cast-iron, weak, but permanent. Magnetism in steel being more readily developed by the contact of magnetizable substances, and particularly if these substances be already magnetic, it was found that the magnetizing effects of percussion were greatly increased, by hammering the steel bar with its lower end resting on the upper end of a large rod of iron or soft steel, both the masses being held in a vertical position, and especially if the rod were first rendered magnetic by hammering. Mr. Scoresby found that small or slender bars acquired a much greater lifting power, in proportion to their weight, than large bars. There was an increase of attraction in bars of the same diameters, when the lengths were increased. The quantity of magnetism developed by this process, was increased by a frequent repetition of the experiment with the same bars.

Mr. Scoresby being desirous of applying the process to the construction of powerful artificial magnets, prepared six bars of soft steel, and bars properly tempered, suitable for a large compound magnet. The soft steel bars were nearly eight inches long, half an inch broad, and a sixth of an inch thick. The bars for the compound magnet, seven in number, which were of the horse-shoe form, were each two feet long before they were curved, and eleven inches

from the crown to the end; when finished, one inch broad and three-eighths thick. These bars were combined by three pins passing through the whole and screwing to the last; and any number of them could be united into one magnet, by means of a spare set of pins screwed throughout their length, and furnished with nuts. In addition to these bars, &c. he provided separate feeders, or conductors, of soft iron, suitable for connecting the poles of each of the bars of the compound magnet, and also another conductor fitted to the whole when combined. To communicate the magnetic virtue, a rod of soft steel was hammered for a minute or two, while held vertically upon a large bar of soft iron in the same position: this gave considerable magnetism to the steel rod. Every one of the six bars of soft steel was then hammered on the top of this steel rod, until the accession of lifting power ceased. Then fixing two of them on a board, with their different poles opposite, and formed by a feeder at each end into a parallelogram, these were rubbed after the manner of Canton, by means of the other four bars, and thus their magnetism was greatly augmented. The other four bars were operated upon in pairs, in a similar way, those already strengthened being used for strengthening the others, and each pair being successively changed, until all the bars were found to be magnetized to saturation. A pair of them now possessed a lifting power of two pounds and a half.

The next step was to touch the bars intended for the compound magnet, by means of these six bars now magnetized. For this purpose the six bars were combined into two magnets, by tying three of them together with similar poles in contact; these two were then placed with opposite poles in connexion, and tied together at one end, but separated about the third of an inch at the other, so as to form one compound magnet, and a conductor was kept constantly applied to the open end of it when not in use, to preserve the power from being lost. One of the bars of the horse-shoe magnet, with a conductor placed across the poles, was now placed on a board, in a groove cut out so as to hold it fast under the operation. The straight bar magnet was then placed erect on the middle of it, with the separated poles downward, and rubbed against the horse-shoe bar from the middle to one of its poles, until the north pole of the one was in connexion with the pole intended to become south of the other; from thence it was rubbed back again, with the south pole of the magnet in advance, as far as the other extremity, or that intended for the north pole of the horse-shoe bar. Two or three strokes of this kind being made from end to end of the bar, on each side of it, the south and north poles of the magnet being always directed to the south and north poles of the bar respectively, the magnet was slipped sideways off when at the pole of the bar, and the bar was found to have acquired such a magnetic power as to enable it to sustain a weight of several ounces hung from the conductor. Each of the bars of the horse-shoe magnet was treated this way in succession, and then the first five bars of the magnet being combined by the screws, were employed in the same way as the soft

steel magnet had been used, for increasing the power of the sixth and seventh bars, by which they were rendered capable of carrying above two pounds weight each. These were then substituted in the combined magnet, for the fourth and fifth bars, while the latter underwent the touch of the other five in combination, and in their turn, the second and third, and then the seventh and first, were subjected to similar treatment. After these operations, which occupied 43 minutes, the compound magnet, with all the seven bars in connexion, lifted ten pounds; after a second series of the same kind of manipulations, five of the bars in combination carried fifteen pounds; and after a third series, eighteen pounds; but as, on trying a fifth series, little augmentation took place, the process was discontinued. The whole of the operations, from beginning to end, occupied above four hours; but as each bar was generally rubbed with twelve strokes on each side, instead of one or two, which were afterwards found to be sufficient, and in other parts of the process a great deal of time and labour were spent, which turned to no account; no doubt but the whole might have been completed, beginning without the smallest perceptible magnetism, and ending with a lifting power of twenty or thirty pounds, in the space of two hours or less. As steel does not receive, immediately on being touched, the full degree of magnetic energy of which it is susceptible, a conductor was applied to the magnet now formed, and it was laid aside, with the view of augmenting its power on a subsequent occasion. [*Rep. of Arts.*

On Improvements in the Art of Engraving on Steel. By Mr. C. Warren.

[From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.]

The death of Mr. Warren, in the interval between the adjudication of the medal and the day of annual distribution of the rewards, prevented the society from receiving a written communication on this interesting subject, from the inventor himself. The following statement, therefore, is taken from the report of the committee to the society, and from details communicated by Mr. Warren's personal friends, especially by Mr. Joseph Phelps, who was pupil to Mr. Warren during the whole progress of his experiments and discoveries.

Some of the earliest specimens of engraving on steel, were produced by Albert Durer. There are four plates etched by this artist, impressions of which exist in the British Museum, which, in all books of art, are recorded as having been executed in steel; of these, one has the date 1510 inscribed on it. Since that time, attempts have been made, occasionally, to employ steel instead of copper, as a material to engrave upon, but, apparently, with little success, on account, principally, of the great hardness of the material, which, in a short time, blunted and destroyed the tools which were made use of.

Steel exists in two states, the elastic and the brittle, the former being considerably softer than the latter; of the elastic steel, a saw-blade may be considered as an example, and, in fact, pieces of saw-blade were the material upon which nearly all the first attempts have been made, of late years, to revive a practice, which, if successful, offered so many advantages to the artist and to the public. Mr. Raimbach, a few years ago, executed an engraving on a block, or thick plate of steel, but met with so many difficulties in the execution, that his experiment remained insulated, and produced no sensible effect on the art of engraving.

Mr. Warren, in his early youth, was much employed in engraving on metals for the use of calico printers and gun-smiths; and the experience thus acquired, induced him, afterwards, to turn his mind to the subject, with a view of applying it to the fine arts. It was suggested to him, by Mr. Gill, one of the chairmen of the committee of mechanics, that the method employed by the artists of Birmingham, in the manufacture of ornamented snuffers, and other articles of cast-steel, is, to subject the steel, after having been rolled into sheets, to the process of decarbonization, by means of which it is converted to a very pure soft iron; being then made into the required instrument, or other article, the ornamental work is engraved, or impressed, on the soft metallic surface; after which, by cementation with the proper materials, it is again converted, superficially, to steel, and thus rendered capable of acquiring the highest degree of polish.

In the attempt, however, to apply this process to plates for the engraver's use, two opposite difficulties occurred. A plate of steel, of the same thickness as that of common copper-plate, when thoroughly decarbonized, and thus reduced to the state of very soft iron, yields readily to the graver and other tools, and, especially, is susceptible of the process of *knocking-up;* this consists in scraping out the error, and afterwards striking the under side of the plate with a punch and hammer, in order to raise the cavity to the general level, and thus allow the artist to take the error out without occasioning any unevenness of the engraved surface: it was found, however, that plates of the thinness requisite for this operation, and of the usual superficial dimensions, were very liable to warp in the last, or re-carbonizing process, and were thus rendered incapable of giving perfect impressions. If, in order to avoid this disadvantage, blocks, *i. e.* plates of three or four times the ordinary thickness, were made use of, the warping, indeed, was prevented, but, at the same time, the process of knocking up became impracticable, and it was necessary, in order to remove an error, or defective part, to grind out the surface, or to drill a hole from the under surface almost through the plate, and then, by forcing in a screw, to raise that part of the face which was immediately above it. This latter process, however, was so tedious and difficult, as exceedingly to detract from the advantage of substituting steel for copper.

In this state of things, it became a very interesting object of inquiry, to ascertain how many impressions may be taken from a plate of soft or decarbonized steel; and it was found that such a plate,

prepared according to Mr. Warren's process, is capable of affording several thousand copies without undergoing any sensible wear. In proof of this, impressions were laid before the committee, by Mr. Warren, from two plates of decarbonized steel executed by him, the one for an edition of Mackenzie's works, published by Cadell, the other for an edition of Beattie and Collins, published by Rivington. These exhibit, both in the landscape and in the figures, the most elaborate and delicate work: five thousand impressions have been taken from one, and four thousand from the other; and yet between one of the first and one of the last impressions it was impossible to detect any perceptible difference.

If Mr. Warren had carried on his experiments alone, working by himself till he had brought his plan to perfection, it is probable that, at the period of his death, the evidence of the great importance of his discovery would by no means have been so complete as it actually was; and the result of his exertions might have been lost, to the great detriment of the profession, and of the fair fame of this eminent artist. But selfishness and secrecy in any thing which related to the improvement of the art to which he was attached, formed no part of his character; and all his discoveries, both those relating to the preparations of the plates, as well as those which have reference to the engraving upon them, were unreservedly and gratuitously communicated. The consequence of this liberality was, that besides the plates of Mr. Warren's own engraving, produced before the committee, impressions were shown of portraits engraved on decarbonized steel for the Evangelical Magazine, demonstrating that, after 25,000 copies have been taken, the plates still remain in a good state, and are not yet in want of repair. Mr. Mar stated, that having made an engraving on one of Mr. Warren's plates, he did not take his own proofs till after the 8000th impression; and, in another instance, the engraving being a portrait, Mr. La Hie, the printer, certified that the artist's own proofs were not taken off till after the 20,000th impression.

Mr. Warren's original process for decarbonizing the steel plates, consisted in procuring a box, or case of iron, and covering the bottom of it with a mixture of iron turnings and pounded oyster-shells; on this a steel plate is laid, another bed of the mixture is then added, and so on alternately, till the box is full, taking care that a bed of the composition shall form the upper as well as the lower layer. The box so charged is then to be placed in a furnace, and to be kept for several hours at the highest heat which it will bear, without melting, after which, being allowed to cool gradually, the plates are found to be reduced, for the most part, to the state of soft decarbonized steel.

Mr. Hughes, a copper-plate maker, having been instructed by Mr. Warren in his process, and finding that the steel did not always turn out sufficiently and uniformly soft (particularly for the purpose of engravers in mezzotinto,) imagined that those occasional defects were owing to a deficiency of heat in the cementing process; accordingly, he substituted a case, or oven, of refractory clay, for the cast-

iron one, and then, applying a considerably higher heat than the cast-iron box would have endured without melting, was enabled to obtain plates so soft, that they may be bent over the knee. Each plate requires two or more cementations; and, as the first cementation warps them more or less, Mr. Warren was in the habit of rectifying them by means of a hammer. Mr. Hughes finds that the places struck by the hammer are apt to be less softened by the second cementation than the other parts, and, therefore, that plates so treated will often turn out unequal in hardness. His own practice is to use a mallet, and as little force as possible, in detaching the cement from the surface, and in rectifying the plate.

The plate being cleaned and polished (but not too highly,) is ready for the engraver. When it comes into his hands, the first operation is, to lay the etching-ground; in doing which, the plate must be rather less heated than is usual with copper, otherwise the ground, as it cools, contracts, presenting a honey-combed surface, and leaving parts of the plate uncovered. The same defect is apt to occur if the plate is too highly polished. The ground should be laid rather thicker than on copper.

Various menstruums were made trial of by Mr. Warren for biting in with. Nitric acid, considerably more diluted than for copper, was made use of, with, upon the whole, good success. Nitrate of mercury was found to blunt or round the edges of the lines: acetic acid, with a small portion of nitrate of copper, produced the same effect: sulphate of copper, bit light tints very beautifully, but its further action rendered the lines rough. The best menstruum, however, is half an ounce of crystallized nitrate of copper, dissolved in a pint and a half of distilled water, and a few drops of nitric acid added to the solution. This will be found to bite both deeper and clearer than dilute nitric acid.

It will be adviseable for the artist, when first etching on steel plate, to keep a register of the time which he finds necessary for the menstruum to act before the parts have attained their due degrees of strength, and this will serve as a guide to him in his subsequent operations. Mr. Warren generally found about two minutes sufficient for an outline, unless it was required to be very strong; the middle tint was produced in about ten minutes, and the darkest shadows in forty minutes. The menstruum should not be more than one-sixth of an inch deep on the plate, otherwise it will be difficult to see the work, and it becomes exhausted in about ten minutes, and then requires to be replaced. While the menstruum is acting, the work must be constantly swept with a camel-hair brush, in order to remove the precipitated copper, which, if allowed to remain in the lines, renders their edges rugged, and destroys their beauty: especial care must be taken to clear the ends of the lines, as these are most liable to bite foul. In stopping out, the ground (Brunswick-black) must be laid on very thin and even, and instead of terminating abruptly, must be smoothed off very gradually; for the smallest ridge or prominence will retain the copper, and then the ground will infallibly be penetrated, and the biting will become foul. By attend-

ing to these directions, an etching may be obtained on decarbonized steel, as deep, and quite as sharp, as it can be on copper.

Concerning the great superiority of steel-plate over copper-plate, for all works that require a considerable number of impressions to be taken, there can exist no doubt: for though the use of the graver, and of the other tools, requires more time on steel than on copper, and though the process of re-biting has not yet been carried to the degree of perfection in the former that it has been in the latter, yet the texture of steel is such, as to admit of more delicate work than copper; and the finest and most elaborate exertions of the art, which on copper would soon wear so as to reduce them to an indistinct smeary tint, appear to undergo scarcely any deterioration on steel; even the marks of the burnisher are still distinguishable after several thousand impressions.

Both the public and the artist are eminently benefitted by this discovery; the public, by having a multitude of impressions as good as copper-plate proofs, and the artist, in greatly extending the range of his reputation by the permanence thus given to the finest and most characteristic touches of his hand.

On the General Nature and Advantages of Wheels and Springs for Carriages, the Draft of Cattle, and the Form of Roads. By Davies Gilbert, Esq. F. R. S. &c.

Taking wheels completely in the abstract, they must be considered as answering two different purposes.

First, they transfer the friction which would take place between a sliding body and the comparatively rough uneven surface over which it slides, to the smooth oiled peripheries of the axis and box, where the absolute quantity of the friction as opposing resistance is also diminished by leverage, in the proportion of the diameter of the wheel to that of the axis.

Secondly, they procure mechanical advantages for overcoming obstacles in proportion to the square roots of their diameters, when the obstacles are relatively small, by increasing the time in that ratio, during which the wheel ascends: and they pass over small transverse ruts, hollows, or pits, with an absolute advantage of not sinking, proportionate to their diameters, and with a mechanical one as before, proportionate to the square roots of their diameters.

Consequently, wheels thus considered, cannot be too large: in practice, however, they are limited by weight, by expense, and by convenience.

With reference to the preservation of roads, wheels should be made wide, and so constructed as to allow of the whole breadth bearing at once; and every portion in contact with the ground should roll on it without the least dragging or slide: but, it is evident from the well-known properties of the cycloid, that the above conditions cannot unite, unless the roads are perfectly hard, smooth, and flat;

and unless the felloes of the wheels, with their tires, are accurately portions of a cylinder. These forms, therefore, of roads and of wheels, are the models towards which they should always approximate.

Roads were, heretofore, made with a transverse curvature, to throw off water, and in that case it seems evident that the peripheries of the wheels should, in their transverse sections, become tangents to this curve, from whence arose the necessity for dishing wheels, and for bending the axes; which contrivances gave some incidental advantage for turning, for protecting the nave, and by affording room for increased stowage above. But recent experience having proved that the curved form of roads is wholly inadequate for obtaining the end proposed, since the smallest rut intercepts the lateral flow of the water; and that the barrel-shape confines carriages to the middle of the way, and thereby occasions these very ruts,—roads are now laid flat, carriages drive indifferently over every part, the wear is uniform, and not even the appearance of a longitudinal furrow is to be seen. It may, therefore, confidently be hoped that wheels approaching to the cylindrical form will soon find their way into general use.

The line of traction is mechanically best disposed when it lies exactly parallel to the direction of motion, and its power is diminished at any inclination of that line in the proportions of the cosine of the angle to the radius. When obstacles frequently occur, it had better, perhaps, receive a small inclination upwards, for the purpose of acting with most advantage when those are to be overcome. But it is probable that different animals exert their strengths most advantageously in different directions, and, therefore, practice alone can determine what precise inclination of this line is best adapted to horses, and what to oxen. These considerations are, however, only applicable to cattle drawing immediately at the carriage; and the convenience of this draft, as connected with the insertion of the line of traction, which, continued, ought to pass through the axis of the wheels, introduces another limit to their size.

Springs were, in all likelihood, applied at first to carriages, with no other view than to accommodate travellers. They have since been found to answer several important ends.

They convert all percussion into mere increase of pressure—that is, the collision of two hard bodies is changed by the interposition of one that is elastic, into a mere accession of weight. Thus the carriage is preserved from injury, and the materials of the road are not broken: and, in surmounting obstacles, instead of the whole carriage with its load being lifted over, the springs allow the wheels to rise, while the weights suspended upon them are scarcely moved from their horizontal level. So that, if the whole of the weight could be supported on the springs, and all the other parts supposed to be devoid of inertia, while the springs themselves were very long and extremely flexible, this consequence would clearly follow, however much it may wear the appearance of a paradox,—that such a carriage may be drawn over a road abounding in small obstacles,

without agitation, and without any material addition being made to the moving power or draft. It seems, therefore, probable, that, under certain modifications of form and material, springs may be applied with advantage to the very heaviest wagons; and consequently, if any fiscal regulations exist either in regard to the public revenue or to local taxation, tending to discourage the use of springs, they should forthwith be removed.

Although the smoothness of roads and the application of springs are beneficial to all carriages and to all rates of travelling, yet they are eminently so in cases of swift conveyance, since obstacles, when springs are not interposed, require an additional force to surmount them beyond the regular draft, equal to the weight of the load multiplied by the sine of the angle intercepted on the periphery of the wheel between the points in contact with the ground and with the obstacle, and, therefore, proportionate to the square of its height; and a still further force, many times greater than the former when the velocity is considerable, to overcome the inertia, and this increases with the height of the obstacle, and with the rapidity of the motion, both squared. But, when springs are used, this latter part, by far the most important, almost entirely disappears, and their beneficial effects in obviating the injuries of percussion are proportionate also to the velocities squared.

The advantages consequent to the draft from suspending heavy baggage on the springs, were first generally perceived about 40 years since, on the introduction of mail coaches; then baskets and boots were removed, and their contents were heaped on the top of the carriage. The accidental circumstance, however, of the weight being thus placed at a considerable elevation, gave occasion to a prejudice, the cause of innumerable accidents, and which has not, up to the present time, entirely lost its influence; yet, a moment's consideration must be sufficient to convince any one, that when the body of a carriage is attached to certain given points, no other effect can possibly be produced by raising or by depressing the weights within it, than to create a greater or a less tendency to overturn.

The extensive use of wagons suspended on springs, for conveying heavy articles, introduced within these two or three last years, will form an epoch in the history of internal land communication, not much inferior, perhaps, in importance, to that when mail coaches were first adopted; and the extension of vans, in so short a time, to places the most remote from the metropolis, induces a hope and expectation, that, as roads improve, the means of preserving them will improve also, possibly in an equal degree, so that permanence and consequent cheapness, in addition to facility of conveyance, will be distinguished features of the M'Adam system. [*Quart. Journ.*

On Fertilizing the Blossoms of Pear Trees. By the Rev. George Swaine.

[From the Transactions of the London Horticultural Society.]

An almost general unproductiveness as to the fruit of the superior varieties of pear trees, has long been the subject of complaint with

horticulturists, both of South and of North Britain. Among the first prizes offered by the Caledonian Horticultural Society, was one "for the communication of the best means of bringing into a bearing state, full grown fruit trees, especially some of the finest sorts of French pears, which (it is stated,) though apparently in a very healthy and luxuriant condition, are yet in a state of almost total barrenness;" and the president of the London Horticultural Society, in his paper on the cultivation of the pear tree, remarks, that "the pear tree exercises the patience of the planter during a longer period, before it produces fruit, than any other grafted tree which finds a place in our gardens; and though it is subsequently very long lived, it generally, when trained to a wall, becomes, in a very few years, unproductive of fruit." But I have no need, at least for my own conviction, to refer to the testimony of others for proof of the existing grievance, possessed as I am myself of a striking instance of this untoward disposition in an individual of the genus Pyrus, which has for a long time baffled all my attempts to alter its infertile habits; it is that of a Gansell's Bergamot, which has grown for twenty years or more in its present situation, against a wall, part of which has a south-west, and part a south-east aspect.

This tree has all the appearance of health, and sufficient luxuriance, and has been for several years constantly covered with a profusion of blossoms at the proper season, but has never before this borne more than three or four pears in any one year, and most frequently not a single one. It never occurred to my observation, before the year 1820, when I was much occupied in the artificial impregnation of different kinds of fruits, that, out of from nine or fewer, to fifteen or more florets, of which the cluster (botanically corymbus) of the pear tree consists, only the three lower ones (generally speaking) *set*, or, in other words, are effectually impregnated for fruiting. Recollecting the practice of the best gardeners, of topping their early beans, *i. e.* of pinching off with the fore-finger and thumb, the uppermost blossoms, some apparent, and others in embryo, of the general spike, for the purpose of setting the lower and earliest ones, which would, otherwise, in most cases, prove abortive, I conceived, that removing the upper and central blossoms of the corymbus of the pear, as soon as it could conveniently be done, would have a similar good effect in invigorating the remaining ones, and causing them to set with greater certainty. With this view, in the spring of 1821, as soon as the three lower blossoms of the corymbi began to show their *white* faces, I set to work with my sharp-pointed scissors on two pear trees, the one the Gansell's Bergamot above-mentioned, and the other a Brown Beurré, and in as short time as I could have properly thinned two dozen bunches of grapes, I divested both these trees of at least three-fourths of all their budding honours. On the Beurré, this operation subsequently appeared to have the best effect; for there was scarcely an instance in which the three remaining blossoms did not *set*, which afterwards produced the finest crop of pears I have yet gathered from that tree. But on the intractable Gansell, although the blossoms at first seemed to set, and many of them did

not fall off till midsummer, when they were nearly as large as common gooseberries, yet not a single pear arrived at maturity. By dissecting many of the largest of those which fell off last, and comparing them with some of the Beurrés of the same age and size, it was plain that the kernels of the former had not been impregnated. This circumstance induced me to think that there must be some imperfections in the essential parts of the blossoms.

In the following spring of 1822, on attending to the blossoms of this tree, which blooms earlier than any other pear tree which I have, they appeared to me to remain much longer in a globular state without expanding than any other variety of pear which I have had an opportunity of noticing. I fancied, likewise, that the pointal was fit for impregnation before the anthers were ripe, and even before the petals expanded; and from the peculiarly slender and delicate make of the latter, as it struck me, I supposed that it ceased to be in a proper state as soon as it became exposed to the sun and air; I therefore concluded, that there might possibly be a chance of obtaining fruit, by depriving the blossoms of their petals before they expanded, and inclosing with each floret in this state, within a paper envelope (as is my mode of effecting artificial impregnation,) a riper *blossom*, *viz.* one that had just begun to diffuse its farina, either one of its own, or, preferably, of some other variety of pear. Accordingly, on the 27th of March, 1822, I began this operation, and in a day or two had tied up in the manner just mentioned, twenty-seven blossoms. Ten of these envelopes contained blossoms of the Beurré pear, which (it not blooming so early as the Gansell) were the only ones I could then find in a state of expansion. Fourteen (to make up, with the former number, two dozen) contained blossom from the same tree, and three blossoms of the pound pear. From the latter presenting a large and coarse appearance, I had very little expectation. I intended to have done many more, but the weather getting colder, and being myself not quite in health, I neglected it till it was too late. The papers were not taken off till the 15th of April, on which day the weather began to be warmer, without sunshine. You will please to observe, that I had previously cut off from all the corymbi with which the tree was abundantly furnished in every part, all the blossoms, except the three lower ones, as in the former year; and that having tied up but one of these in each corymbus, I immediately cut off the *two* remaining ones. The blossoms were operated on in different parts and aspects of the tree; for part of it, as I said before, faced the south-east, and part the south-west. Of the *ten* blossoms, treated with the Beurré pear, *eight* set, two of which afterwards fell off, but I suspect not fairly, and six are now proceeding to maturity. *One* only of the *fourteen*, where its own blossoms were used, now remains. Of the *three* wherein the pound pear was concerned, the whole failed. The only pear now on the tree which set naturally, and on which no operation was performed, was produced on a cluster of blossoms, at the extremity of a leading horizontal shoot of last year, which did not make its appearance till after the others had dropped off. This circumstance, by the way,

proves that the fruiting buds of the pear do not invariably require *three* years for their perfection, since the bud, naturally the most productive on the tree in question, could not have been visible, at farthest, before the middle of last summer. As the pears are now from five and a half to seven and a half inches in circumference, I consider them as past all danger of failure, or rather, that they will only fail through the application of violence. Three are in a line within the space of twelve inches near the centre of the tree, and one is on a branch which I considered, at the time of the operation, to be the most unlikely to succeed, as being in the most exposed situation.

Whether the result of the above detailed experiments be such as to authorize an expectation that artificial assistance in vegetable fecundation will hereafter become of so much importance to gardeners in the instances just alluded to, as in those at present recognised, of the cucumber, the melon, the early bean, and the hautbois strawberry, must be left to futurity to ascertain.

Report on the Prize for the Manufacture of Scented Russian Leather. By M. Merimee.

[From the Bulletin de la Société d'Encouragement.]

Gentlemen, considerations, dictated by prudence, determined you to require a year's trial before adjudging the whole prize offered for the manufacture of odorous leather, possessing all the qualities of Russian leather. The time of trial is elapsed, your hopes are realized, new efforts have produced improvements, and France is now in possession of a process which was a desideratum to our industry.

When your committee verified the experiments of Messrs. Grouvelle and Duval-Duval, it was remarked, that particular precautions were necessary in order to be able to impregnate the skins, without staining them, with the empyreumatic oil, which renders them odorous. That oil, as it was then obtained, was fat, and very much coloured. The method of distilling it has since been improved. The oil obtained at present is much thinner, and colours so little, that moroccos of the clearest shade may be strongly impregnated with it without losing any thing of their brightness.

Deceived by experiments which he had not had time to carry far enough, M. Grouvelle had asserted, in the memoir which he drew up, that the aromatic scent of birch-oil does not exclusively proceed from the resin to which M. Chevreul gave the name of *bétuline.* The observations of your committee have induced him to make new experiments, which have led him to find out, that if the epidermis of the birch still affords scented oil after a long digestion in alcohol, it is because the last portion of the resin adheres so to the tissue of the epidermis, and cannot be removed completely. M. Grouvelle,

in a note addressed to your committee, declares, that he is now persuaded that the aromatic odour of birch-oil is produced by betuline, and he has determined the proportions of them approximately.

He has, moreover, at our request, verified an observation which we had made last year, and which explains the difference observed between the leathers newly prepared and those of Russia.

We had thought that we discovered in some Russian leather, bought in England, a mixture of the smell of cedar-wood. In consequence, we distilled some cedar saw-dust, hoping to find, in the product, the same odour that is disengaged when a little of this wood is thrown upon live coals. We were deceived in our expectation; for we obtained only pyrolignous acid and a very thick oil, smelling only of tar. However, a piece of leather impregnated with this oil, lost that disagreeable odour in the air by degrees, and after some months, the aroma of the cedar remained alone, nearly without mixture.

This fact explains why leather prepared recently has not the same smell as Russian leather, which does not reach us till long after it has been manufactured. The birch-oil retains, always, a little pyrolignous acid and tar. Both evaporate in the air, and then the smell of the leather is as pure as it can be.

In Fischerstroem's memoir on the *juchten* or Russian leather, a memoir from which an extract was inserted in the Bulletin for November 1822, it is said that if only the bark of the willow (*saule*) or poplar is employed, instead of oak bark, which has much greater energy, it is because the oak does not grow in high northern latitudes. We have, in many of our forests, oak in abundance; but it grows slowly, and is not found in every part of France. Poplar bark might, therefore, as we have observed, be employed with advantage, and the only effect of such a tannage would be, to give the leather a scent, which would cause it to be preferred: now this quality is not to be disdained, for in Italy the smell of our French leather appears generally insupportable.

With this view, another tree may be mentioned, not very common at present, but which is easily inured to the climate, the tulip-tree. Its bark diffuses a very agreeable spicy odour, and contains a great deal of tannin; therefore there is good ground for believing that leather prepared with the bark of the tulip-tree, would retain a part of the perfume which it exhales.

[TO BE CONTINUED.]

Answer to the inquiry of a Subscriber, in the last number, respecting the best method of raising water from a well fifty feet deep. By S. V. Merrick, Hydraulic Engineer.

Philadelphia, March 1, 1829.

Mr. Editor,—A subscriber, in your last number, requires the best mechanical method of raising water from a well fifty feet deep, for domestic and culinary purposes.

The awkward mode of raising water by the counter balance weight, will not answer for so great a depth, and the more laborious wheel and axle ought to be exploded, wherever a pump can be procured: independent of other serious objections to them, the danger incident to an open well, where children frequent, is evinced by the accidents which continually occur.

I know of no method of producing the desired effect, equally simple and advantageous with what is commonly called the sucking pump. The action of this pump depends principally upon the pressure of the atmosphere on the surface of water, by which a column of the fluid is forced into a vacuum formed by raising the upper pump box.

The weight of the whole atmosphere will sustain a column of water 34 feet in height. It would follow, that upon this principle, a pump of greater length than 34 feet would not act; this difficulty vanishes, by giving to the pump rod such a length as shall bring the upper box within the required distance of the surface of the water in the well.

On the principle above alluded to, I have said that the atmosphere will sustain a column of water 34 feet in height, and in theory, a pump, the upper box of which is within that distance of the surface of the water, will operate. In practice, however, it will be found extremely difficult, if not impossible, to create a vacuum sufficiently perfect; and unless that is done, no useful result is to be expected. The nearer the upper box is placed to the water, the more certain will be its operation; and I would not advise, in any case, to exceed twenty or twenty-five feet; as even at this height, the working chamber and piston will require to be very well made. I have always found, in my experience, that the more perfect a machine is made, the cheaper it will eventually prove; although the original cost is enhanced, this expenditure has proved to be good economy.

This remark applies with great force to pumps: if air escapes by the boxes, their operation is seriously affected, if not entirely destroyed. The failure of a house pump may, generally, be attributed to its bad construction; and it is not only a serious inconvenience, but often a greater loss, in the time and labour of carrying water from a distance, than the additional cost of the best instrument, above that of the ordinary log pump. The West India planters find it the best economy to use copper pumps in all cases; the great heat of their climate rendering wood unsafe, from its being apt to split, whilst pump makers are not so numerous as in this country; but for all ordinary purposes, the wooden log, as a tube or conduit, is sufficiently good. For a deep well, the logs should be cut into convenient lengths, taking care that there be a joint about the place intended for the working chamber, say twenty feet from the surface of the water; this may be in the upper end of the lower log; within this insert a lining of brass, or composition, about 16 inches long, and bored out true; this lining should be driven firmly into the wood, which has previously been reamed out the proper size. The lower end of this lining should be bevelled from the inside, to a feather

edge, that no obstruction may remain to prevent the lower box passing through, when it becomes necessary to remove it, after the logs are fixed. In the pump log, below the lining which is there reamed taper, should be placed the lower box or valve, well wrapped with greased hemp, and driven in tight. The hemp packing prevents the passage of air or water round the box.

This box may be made of wood as usual, but as the certain and effective operation of a pump depends entirely on the tightness of its valves, I would recommend that both box and valve be of metal, and without the intervention of leather. The seat of the valve should be a rim of brass, having a groove on the outside to hold the hemp packing, and the inside turned to receive a conical valve made to fit, and both ground together with fine sifted loam till they become water tight. An iron staple ought to be inserted in the rim, that it may be drawn up when necessary.

The upper, or working box, may be constructed in the same manner, and be surrounded with leather, having a similar staple, to which the pump rod is attached.

The ordinary mode of nailing the leather round the wooden box, is very objectionable, and cannot be practised when it is of metal. A method of leathering metal pistons, has been devised, so simple that it may be executed by any worker in wood. It is as follows: take a piece of moderately hard sole leather, cut it into a circular form about three inches larger than the diameter of the pump barrel. To form this leather into the shape required to surround the box, cut a circular hole through a piece of hard plank, a little tapering, the large end of which should be the size of the pump bore, then form a wooden plug, so much smaller than the hole, as to admit two thicknesses of the leather between the plug and the rim, or rather one thickness all round; when thus prepared, wet the leather, lay it over the large end of the hole in the plank, and drive it through with the plug. It is evident the leather must form round the plug, and be so compressed as to take the shape of a cup; if left in the press until dry, it retains its form. This done, cut out the bottom of the cup within the turn, leaving a bevelled edge; wet it and force it on the box. The lower edge may be secured on the box by driving on a brass ring, or by copper wire, which is preferred to iron, from being less liable to corrode. The cost of a pump lining 3½ inches diameter in the clear, with a pair of brass boxes, with poppet valves, as described, would not exceed 16 dollars. It would outlast numerous sets of pump logs, and the only repairs required would be a renewal of the leather surrounding the piston, every few years. From its not being liable to swell, shrink, or decay, no danger of a failure need be apprehended, and the original extra expense would be amply repaid in a short time, by saving the cost of repairs.

Note by the Editor.—It is our intention to enlarge upon the preceding remarks of Mr. Merrick, by giving some practical rules for the construction of pumps. Where metallic chambers and valves can be procured, there is no question respecting their superiority;

this, however, is not generally the case, whilst there are few places where pumps, with wooden boxes, might not be well made, were the workmen informed respecting the construction of the different parts. To accomplish this end, it will be requisite to present some drawings, which we will have executed for the purpose; they, however, cannot be ready for the next number.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On the Rotary Steam Engine.

The frequent appearance and disagreement of essays, comparing the respective merits of the rotary and reciprocating steam engine, elicits the following observations.

It is established, and admitted, that there is a law of nature, whereby the intensity of a great force may be compensated by the velocity of a smaller force, or, that a force of 2 lbs. moving one foot, produces an equal mechanical effect with a force of 1 lb. moving two feet.

In other words, that the effect of any given force is, as the space passed through, or described, whether in a right line, or in a curve.

If 2 lbs. be suspended from each end of a balance, or lever, of the first order, equi-distant from the supporting centre, the lever will be balanced, and a pressure of the combined weights, viz. 4 lbs. be on the fulcrum.

If one of the weights (of 2 lbs.) be removed, and a weight of 1 lb. placed at double the distance from the centre, the lever will still be balanced, but a pressure of only 3 lbs. (2 and 1,) will be sustained by the fulcrum. Now there is no reason, *a priori*, why a force of 2 lbs. on one side the centre, should be counterpoised by 1 lb. on the other, because of its greater distance; it is still but 1 lb., and only presses downwards on the fulcrum with a force of 1 lb. The arbitrary term "leverage," will not avail us any thing; it implies merely that the 1 lb. is at a greater distance from the centre than the weight of 2 lbs.

It is then only in reference to *motion* that the 1 lb. is equivalent to 2 lbs.; and if we suppose the 2 lbs. to preponderate for a small, though determinate distance, the greater motion of the 1 lb. would restore the equilibrium, by the law above cited.

We have, therefore, to suppose, that motion can only be generated by the preponderance of the 2 lbs., simultaneously with the compensating property created by such motion, and we then have the two unequal weights balanced, although at rest.

This proposition might, probably, be stated more clearly, and it may add to its elucidation, to say, that the motion generated, and its compensating effects, are cotemporaneous, in the same manner as the balancing qualities of action and re-action.

It is difficult to conceive of cause, (action,) not existing prior to the effect, (re-action,) yet we find that it is so; and this example is perfectly analogous to that of the lever with the unequal weights.

With regard to the ratio, in which velocity will compensate for power, although we see that a double velocity of a given force, produces a double effect, (such is the law) yet there is no violation of pure science, to suppose any other ratio, i. e. there is no mathematical necessity for the law being in this ratio, in preference to any other.

By mathematical necessity, I mean, such as does exist that the diameter of a circle shall always bear the same proportion to the circumference, notwithstanding we have been unable, hitherto, to express that proportion exactly, in any other characters than lines.

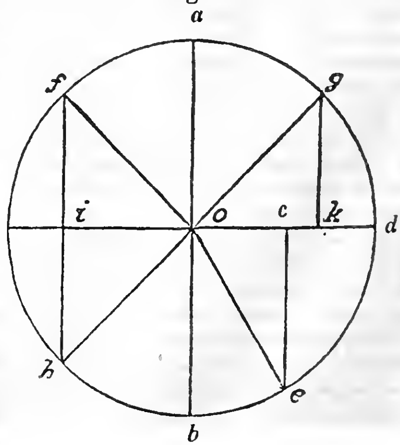
Men of science, both practical and theoretical, have evinced more inconsistency in relation to the crank motion, and the rotary engine, than on any other subject, and those, too, who, on the suggestion of a perpetual motion, could scout the idea of a *gain* of power by any arrangement of machinery, or specific application of force—but who will strenuously contend for a *loss* of power, (apart from friction,) in converting the alternating rectilinear motion, into the rotative.

If we would submit our judgments *to*, as we admit the existence *of*, the foregoing law of motion, though it may not always quadrate with our ideas, many mistakes, and much controversy, might be avoided.

Figure 1 consists of a circle, representing the centre of a hollow ring, in which the piston of a rotary engine is supposed to work, and the line *a*, *b*, a cylinder, whose piston has the same area as that of the rotary engine, with a length of stroke equal to the diameter of said hollow ring.

In the time that the piston of the rotary engine shall have made one revolution from *a*, round the circle, to *a* again, the piston of the cylinder will have descended from *a* to *b*, and ascended back to *a*.

Fig. 1.



Then the distances, described by the two pistons, are, as the circumference of the circle to twice its diameter; consequently, the mechanical effect, and also the consumption of steam, are in the same ratio, or as 3.142 to 2.

Now, we may make what calculations we please, and put all the powers of arithmetic and algebra in requisition to our aid, "to this complexion must we come at last."

It may be well to remark, that the centre of percus-

sion, on the piston of the rotary engine, or the circle, which should cut the aunulus, or hollow ring, so that the part of the piston, within and without such dividing circle, should have equal effect, would not be in the centre of the ring, but so far without the centre, as would leave equal contents in the aunulus on each side.

If this were not the case, the effect would not be as we have just asserted, viz. in proportion to the steam used (under equal circumstances.)

The correspondent in the Franklin Journal for December, signed "a hammer," falls into the very popular error, of supposing that when the crank of the reciprocating engine makes an angle of 45° with the force applied, that the mechanical advantage, or leverage, is only one half of the maximum point, or when at right angles.

I must here urge another axiom, that the true length of the lever, is in all cases as the length of a line, produced perpendicularly, from the direction of the force, to the fulcrum, or centre. Therefore, when the crank makes an angle of 30° with the direction of the force, as at *e*, it is at half its power, *c*, *o*, being half *d*, *o*, and if "a hammer" will apply this simple process throughout the quadrantal arc, *d*, *b*, described by the crank, in the time of the piston's descent from *o* to *b*, he will find the deficiency in effect, compared to the rotary engine, as the semidiameter, *o*, *b*, to the arc, *d*, *b*, or as before stated, as 2 to 3.142.

It follows, then, if I am correct in the preceding remarks, that there is no advantage, or gain of power, in theory, by the rotary engine; and we know that there are almost insuperable practical objections. The loss, or rather inferior effect, of the reciprocating engine, is met by a corresponding saving of steam, so that to produce the same power, it is only necessary to enlarge the cylinder so much, that twice its contents shall equal those of the hollow ring.

That there is no loss in the reciprocating engine, by the alternating motion of a heavy weight, connected to the crank, was suggested in a communication in this Journal, of May last, since which, I have received opinions from authority in these matters, that leave no doubt on my mind. One of my correspondents calls the idea of a loss of power from this cause, "an *inadvertency* that only requires pointing out, to be acknowledged."

The best rotary engine I have ever seen, was constructed by Mr. Rutter, of this place, and applied to a small boat. The principle of cutting off the steam, and benefitting by its expansion, was in this engine carried to as great an extent as is usual in reciprocating high pressure engines.

The difficulty of keeping it tight and in order, caused it to be supplanted by an engine of the common kind, using the expansion of the steam in the same degree, without any alteration in the boilers, and the result was, that when burning fuel in the same ratio as with the rotary engine, the boat would run 8 miles an hour, whereas about $7\frac{1}{2}$ miles an hour was the former speed.

It is frequently supposed that when there are two cylinders and cranks connected to the same shaft, at right angles, that equal power

to turn the shaft is exerted at every point in the revolution. An inspection of the figure 1, will make the error of this supposition apparent.

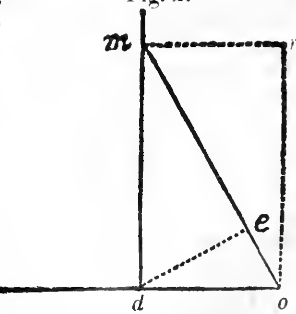
Let *a*, *d*, be the two cranks, at right angles to each other, *a*, on the centre (or dead point) and *d* acting at its greatest power, equal to the length of the lever *d*, *o*, which call 100.

Then, when the cranks are in the relative situations, *f* and *g*, *g* being forced downwards, and *f* upwards, with the leverage of the arms *i* and *k*, each of which levers is as 70 to 100, there is a power exerted to turn the shaft of 140.

If to lessen the greater power at this point, than the first mentioned, we bring the cranks nearer together, we are increasing the power, when the cranks are in the situations *f* and *h*, where we have already a similar power to the last, or 140. And we can approximate no closer to equality, than as 100 to 140.

The use of lines to express the intensity and direction of forces, is well known, and I will here introduce a familiar application of the principle. Let the line *m*, (figure 2,) be the mast of a vessel, of which *d* is the deck, and *m*, *o*, the shroud; draw *m*, *n*, of any length, from the point against which the pressure of the sail is supposed to act, and in the direction of said pressure, as *n*, *m*; draw the line *n*, *o*, perpendicular to *n*, *m*, draw *m*, *o*, in the direction of the shroud, till it touch *n*, *o*. Then we have the triangle *m*, *n*, *o*, each side of which expresses by its length and direction, the intensity and direction of the several forces; *n*, *m*, the sail against the mast, *m*, *o*, the strain on the shroud, and *n*, *o*, the force exerted by the shroud downwards on the mast.

Fig. 2.



If we turn the figure so as to bring the line *m*, *d*, in a horizontal position, the triangle *d*, *m*, *o*, may represent the half of a framed bridge; draw *m*, *n*, to express any weight on the bridge at *m*; draw the base line *n*, *o*, perpendicularly to the same, and, also, the line *m*, *o*, in the direction of, and which now represents, a brace resting on the abutment at *o*.

Then the sides of the triangle *o*, *m*, *n* will represent the three forces forming and balancing the system; *m*, *n*, the weight on the bridge, *m*, *o*, the pressure by the brace, on the abutment, and *d*, *m*, the pressure in the direction *d* to *m*, which is balanced by the opposite half of the bridge; but which, if the figure be considered as representing a crane, would be sustained at *d*.

The difference in intensity of one force to balance another, arising from obliquity in direction, may be resolved into the lever of different lengths, from which the reference to motion as the governing principle is easy. Retaining figure 2 in the position suited to the representing of half a bridge, (and always bearing in mind that the

true length of the lever is a line drawn at right angles from the direction of the force to the centre or fulcrum,) let *m*, *n*, be the weight acting on the lever *m*, *d*, of which *d* is the fulcrum, from which draw *d*, *e*, perpendicular to *m*, *o*, the brace.

Then the weight *m*, *n*, acting on the long lever *m*, *d*, will balance the greater force sustained by the brace *m*, *o*, on the short lever *e*, *d*, *d* being the fulcrum of both, and the weight *m*, *n*, acting on the long lever *n*, *o*, of which *o* is the fulcrum, will balance the greater force *d*, *m*, (which would be opposed by the other half of the bridge,) on the shorter lever *d*, *o*, of which *o* is likewise the fulcrum.

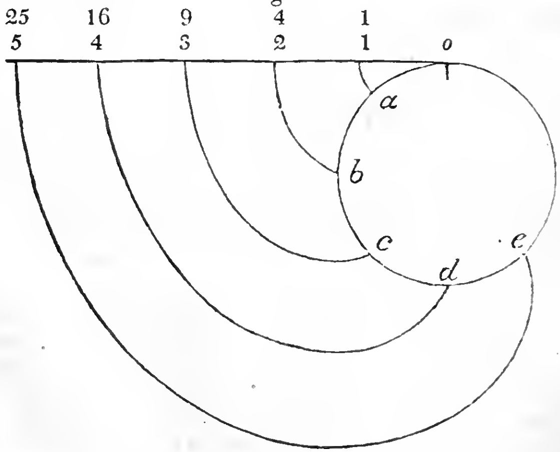
If we now place the figure in its first and erect position, the force of the sail *n*, *m*, against the lever *m*, *d*, is balanced by the greater required force on the shroud *m*, *o*, by the proportionably shorter lever *e*, *d*, *d* being the fulcrum of both. And the force of the sail *n*, *m*, on the lever *n*, *o*, (*o* being the fulcrum) is equal to the greater force downwards on the mast *n*, *o*, and sustained by the proportionably shorter lever *d*, *o*. There is no case in the resolution and composition of forces, in which we use either the triangle or the parallelogram and its diagonal, that may not be explained by the lever of different lengths and its obvious reference to motion.

It was long a disputed point amongst philosophers, and is not yet entirely settled, whether the momentum of matter be as the quantity multiplied into the velocity, in simple ratio, or as the quantity multiplied into the square of the velocity.

One of the arguments growing out of the latter opinion, is, that "a double projectile velocity will balance a quadruple centripetal force."

I introduce this subject, with a view of showing the power of lines to express the central forces.

Fig. 3.



Let the circle, figure 3, represent the orbit of a body revolving round a centre of attraction, and the projectile velocity be such,

that in a given time the body would describe the distance from *o* to 1, were it not for the attracting force acting always at right angles to the projectile, and in consequence of which, the body describes the same distance in the arc *o*, *a*, and is found in the orbit at *a*.

It is evident that as the attraction is ever at right angles to the tangential line of the orbit, the direction of the attraction will vary at every point from *o* to *a*, and can only be represented by a similar curve to 1 *a*.

The order of this curve is called the involute, and may be generated by a thread proceeding from *o* to 1, with a marking point attached at 1, brought down to *a*, the thread being kept tight and closing round and against the circle, and the other curves represented in the figure, are produced in the same manner.

Then, if we imagine the velocity doubled, so that the body would be carried from *o* to 2, in the time it would have been projected only to 1, and the attracting force sufficiently increased to preserve it in the orbit, the body would be found at *b*, but the curve 2 *b* is four times the length of the first curve, (1 *a*,) and expresses an attracting force of four times the intensity. And, although "a quadruple centripetal force is requisite to balance a double projectile velocity," it is only requisite, because the space passed through (or overcome,) is four times as great.

The required attracting force represented by the several curves, is always as the square of the projectile velocity, as by the numbers annexed in the figure. This rule will hold good to any extent, so that the line expressing the projectile velocity might be of such length as to require the thread by which the curve would be drawn to express the attracting force, to wind round the circle any number of times before the marking point should arrive at the orbit.

THOMAS W. BAKEWELL.

Cincinnati, February 20, 1829.

AMERICAN PATENTS.

PATENT CAUSE.

Decision of the Supreme Court of the United States, on the effect of delaying to obtain a patent after an invention is completed; in the case of ABRAHAM L. PENNOCK *and* JAMES SELLERS, *versus* ADAM DIALOGUE.

THE question has frequently been agitated, whether an inventor could sustain a claim to a patent, which he had obtained, after having allowed the invention to go into public use. Although this question had remained undetermined until the decision alluded to in the title of this article, it had been incidentally brought up in our courts of law. In the case of Whittemore, *v.* Cutter, 1 Gallison's Reports, 478, judge Story declares, that, if the original inventor of a machine, &c., suffers it to be freely and fully used by the public at

large, for such a length of time, that this devotion to the public use can be fairly inferred, he cannot afterwards resume the invention, and take out a patent. In the case of Evans *v.* Weiss, (Fessenden on patents, p. 52.) judge Washington is represented to have said, "It must be confessed, that cases of great hardship may occur, if, after a man shall have gone to the expense of erecting a machine, for which the inventor has not then, and never may obtain, a patent, he shall be prevented from using it, by the grant of a subsequent patent, and its relation back to the patentee's prior invention."

"Not only may individuals be injured by a liberal construction of the words of the law, but the public may suffer, if an obstinate or negligent inventor should decline obtaining a patent, and at the same time, keep others at arm's length, so as to prevent them from profiting by the invention, for a length of time, during which the fourteen years *are not running on.*"

In the case of Pettibone *v.* Derringer, tried before judge Washington in 1818, it appears, he did not then consider this question as settled; but he observes, that, "if the patent may relate back to the discovery, however remote, it is obvious that the inventor possesses, to a certain degree, all the rights of a patentee, in addition to those rights which are secured to him by patent. For, in the case of costly machinery, what man would venture to construct and use it, without the permission of the inventor, and without purchasing from him that permission, if the inventor might, at any time afterwards, take out a patent, and forbid the subsequent use of it. Thus the inventor may hold all the world at arm's length, as long as he pleases, and enjoy, to a certain degree, the fruits of his discovery during all that time, and finally secure the right, in its full extent, for fourteen years more, by obtaining a patent."

In the case of Huntingdon *v.* Morris, judge Thompson is of opinion, "That no man should be permitted to lay by for years, and then take out a patent: but that if he was practising his invention, with a view of improving it, and thereby rendering a greater benefit to the public, before taking out a patent, that should not prejudice him." He also observes, "It should always be a question submitted to a jury, what was the intent of the delay of the patent, and whether allowing the invention to be used without a patent, should not be considered an abandonment, or a present of it to the public."

By the kindness of the Reporter of the Supreme Court of the United States, who has placed his MS. report in our hands, we are enabled to present our readers with an abstract of the case, named at the head of this article, and of the opinion thereon delivered by judge Storey.

This case was brought before the court, on a writ of error, to the Circuit Court of the Eastern District of Pennsylvania.

In that court, the plaintiffs had instituted their suit against the defendant, for an infringement of a patent right for "an improvement in the art of making tubes or hose for conveying air, water, and other fluids." The invention claimed by the patentees, was in the mode of rivetting the hose, so that the parts so joined together would

be tight, and as capable of resisting the pressure as any other part of the machine. From the evidence given in the Circuit Court, it appeared, that the invention was completed in 1811, but that the letters patent were not obtained until 1818, and that, in the interval, upwards of *thirteen thousand feet of the hose* were made and sold in the city of Philadelphia, by an individual, who had been instructed in the mode of making, and permitted to sell it, by the inventors. It was not alleged, on the part of the plaintiffs, that, during the period which had elapsed, the manufacture had undergone any important modification, or improvement, but they claimed before the jury, that all the hose, which had been made and sold, had been so, under their permission.

Upon the whole evidence in the case, the Circuit Court charged the jury, "We are clearly of opinion, that if an inventor makes his discovery public, looks on, and permits others freely to use it, without objection, or assertion of claim to the invention, of which the public might take notice; he abandons the inchoate right to the exclusive use of the invention, to which a patent would have entitled him, had it been applied for before such use. And, we think, it makes no difference in the principle, that the article so used, and afterwards patented, was made by a particular individual, who did so, by the private permission of the inventor. As long as an inventor keeps to himself the subject of his discovery, the public cannot be injured; and, even if it be made public, but accompanied by an assertion of the inventor's claim to the discovery, those who should make or use the subject of the invention, would, at least, be put upon their guard. But, if the public, with the knowledge and tacit consent of the inventor, is permitted to use the invention without opposition; it is a fraud upon the public, afterwards, to take out a patent. It is possible, that the inventor may not have intended to give the benefit of his discovery to the public, and may have supposed, that, by giving permission to a particular individual to construct for others the thing patented, he could not be presumed to have done so. But, it is not a question of intention, which is involved in the principle which we have laid down, but of legal inference, resulting from the conduct of the inventor, and affecting the interests of the public."

Upon this charge, the jury gave a verdict for the defendant.

The exceptions taken to this charge, by the plaintiffs, were, in substance,

That, from its nature, the trial of the article was necessarily public; and its abandonment was rebutted, by the article being made and sold exclusively under their permission. That this use of the invention, thus guarded, could not take away their rights, unless after an unreasonable lapse of time, or gross negligence in applying for a patent. That the jury ought to have been instructed, that the making by permission, was an assertion of their claim, and, that the public, by purchasing under this permission, only, acquired no title to the invention.

We do not deem it necessary, to state the points contended for

in the able arguments of Mr. Webster, for the plaintiffs, and of Mr. Sergeant, for the defendant; those interested, will find them in the volume of reports, when published; we proceed, therefore, to our abstract of the opinion of the court.

The whole of the testimony, in the case, given before the Circuit Court of Pennsylvania, was embodied in the bill of exceptions; but this was considered by the Supreme Court, as altogether extraneous, and not properly before them for consideration; the single question being, "whether the charge of the court was correct in point of law." That an inventor may abandon his invention to the public, was considered as an undenied fact, and, that after doing so, he could not, at his pleasure, resume it; gifts once made to the public, becoming absolute, the question, which generally arises, being rather on the fact, than on the law; that is, whether the acts of the party furnish a sufficient proof of abandonment.

The facts stated in the charge of the court, it is observed, are not to be reviewed independently of statutable provisions; the proper exposition of the patent law being necessary to the correct answer to any such inquiry. The constitution gave to Congress, the power "to promote the progress of science, and the useful arts, by securing *for limited times*, to authors and inventors, the exclusive right to their respective writings or discoveries." The limited time was fixed by the act of 21st February, 1793, which also prescribes the terms and conditions, which must be strictly complied with. The thing patented is to be such as was "*not known or used before the application;*" and the patent is granted "*for a term not exceeding fourteen years;*" and gives "the full and exclusive right of *using, and vending to others to be used*, the said invention or discovery," &c. A defendant, charged with having infringed a patent, may plead, "that the thing was not originally discovered by the patentee, *but had been in use*, or, had been described in some public work, *anterior to the supposed discovery by the patentee.*"

These clauses were considered as materially bearing upon the question before the court.

The meaning of the words, "*not known or used before the application,*" cannot be, that the thing was not known or used by the inventor himself, as it is upon his knowledge that he obtains a patent; and, without which, he could not judge of its competency to the end proposed. The words, therefore, must mean, not known or used by others, excepting so far as the employment of others might be necessary to its completion, and excepting, also, the case of piracy. The true meaning, the court concluded, 'was, *not known or used by the public, before the application;* and thus construed, there is much reason for the limitation thus imposed by the act;' with the exception of the limited time, the public have a right to the thing invented. 'If an inventor should be permitted to hold back from the knowledge of the public, the secrets of his invention; if he should, for a long period of years, retain the monopoly, and make and sell his invention publicly, and thus gather the whole profits of it, relying upon his superior skill and knowledge of the structure; and then, and then

only, when the danger of competition should force him to secure the exclusive right, he should be allowed to take out a patent, and thus exclude the public from any further use than what should be derived under it, during his fourteen years, it would materially retard the progress of science and the useful arts, and give a premium to those who should be least prompt to communicate their discoveries.'

The court noticed the similarity of the provisions of the patent law of England, and that of the United States, as respects the requirement, that the thing patented be new; and in the practice, under the English law, cited the case of Wood *v.* Zimmerman, (1 Holt's N. P. rep. 58) where the inventor suffered the thing invented to be sold, and go into public use, for four months before the grant of his patent; and it was held by the court, that on this account the patent was utterly void. Lord chief justice Gibbs said, "The *public* sale of that which is afterwards made the subject of a patent, *though sold by the inventor only*, makes the patent void." It is observed, that, although the words of our statute are not identical with that of England, yet their structure is so similar, as to render it evident, that they were in the contemplation of the framers of it. The hardship which a particular construction of the words may be thought to import, in particular cases, cannot be made the rule of their interpretation. 'If an invention is used by the public, with the consent of the inventor, at the time of his application for a patent, how can the court say, that his case is, nevertheless, such as the act was intended to protect? If such a public use of it, is not a use within the meaning of the statute, what other use is? If it be a case, within the meaning of the statute, how can the court extract the case from its operation, and support a patent, where the suggestions of the patentee are not true, and the conditions, on which, alone, the grant was authorized to be made, do not exist?'

The operation of laws, having similar objects, the policy of bringing inventions into early use, and the fair construction of the words of the statute, were considered as sustaining the opinion given, and manifesting the will of the legislature, a will which the court were bound to obey.

After some remarks upon certain expressions in the sixth section of the act of 1793, which might at first appear to militate against the construction given to other parts of the same act, the opinion concludes as follows:

'It is admitted, that the subject is not wholly free from difficulties, but upon most deliberate consideration, we are all of opinion, that the true construction of the act is, that the first inventor cannot acquire a good title to a patent, if he suffers the thing invented to go into public use, or to be publicly sold for use, before he makes application for a patent. His voluntary act, or acquiescence in the public sale, or use, is an abandonment of his right, or rather creates a disability to comply with the terms and conditions, on which alone the Secretary of State is authorized to grant him a patent.'

'The opinion of the Circuit Court was, therefore, perfectly correct, and the judgment is affirmed, with costs.'

LIST OF AMERICAN PATENTS GRANTED IN DECEMBER, 1828.

With Remarks and Exemplifications, by the Editor.

1. For an improvement in the art of manufacturing all articles formed by *Pressing Melted Glass into Moulds;* Deming Jarves, Boston, Massachusetts, December 1.

(See the specification.)

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2. For an improvement in the *Ship Windlass*, for weighing anchors, called "Nicholson's improved Ship Windlass;" Samuel Nicholson, Boston, Massachusetts, December 1.

Patents for several different modifications of, and improvements upon, the windlass and capstan for ships, have, within a few years, been obtained in England; whether either of the plans may be likely to interfere with that of Mr. Nicholson, we shall not at present inquire, but merely give an outline of his plan.

The patentee proposes several different methods of procedure, one of which is represented in the drawing which accompanied his papers, and this he probably considers the best. A cast-iron cog-wheel is fixed upon the end of the windlass. In front of this is fixed another cog-wheel, or pinion, one-third of the diameter, and which geers into the former. One of the gudgeons of this wheel works in the pieces of timber, (bitts,) which support the windlass, and the other in a post, or standard, firmly fixed in the deck for that purpose. A pronged, or forked lever, embraces this smaller wheel, the forked ends being perforated so as to admit, and turn upon its gudgeons. On one side of this wheel, teeth are cut so as to form a ratchet wheel, into which teeth, a ratchet, or catch, attached to the lever, takes; so that when the lever, or handspike, is forced down, it turns the wheel and windlass; the ratchet sliding over in the usual way, as the lever is raised to take a new hold.

An arrangement somewhat similar, is proposed to be applied to a capstan; the levers, of course, working horizontally.

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3. For *Extracting the Gum or Vegetable Matter from unrotted Flax or Hemp*, after its being spun into rope-yarn; Sands Olcott, Harsimus, Bergen county, New Jersey, December 1.

The yarn is to be coiled within tubs, or vats; these are to be filled with water, and the yarn allowed to soak for three or four days; at the end of this time, the water is to be drawn off, and renewed, and this repeated until it passes off perfectly clear. The yarn may then be tarred, or it may have the water wrung out, and be hung up to dry. The process may be hastened by elevating the temperature of the water.

The claim is as follows. "What I claim as new, and my own invention, or discovery, in the above described art, and for the use

of which I ask an exclusive privilege, is, the process of extracting the gum or vegetable matter from unrotted flax or hemp, after its being spun into rope yarn, it being a much quicker and less expensive way of extracting it, than the old way of rotting it in the stalk, or cleansing it in the hurl."

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4. For an improved mode of manufacturing the metallic salts, usually denominated *White Lead*, or Carbonate of Lead; *Carbonate of Copper; Acetate of Copper; and Acetate, or per Acetate of Iron;* Edward Clark, Civil Engineer, New York, December 4.

The patentee is now engaged in testing the principles, and perfecting the process for which he has obtained a patent, and will hereafter supply an article upon the subject, which will be more valuable than the outline which we should otherwise give.

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5. For an improved construction and position of *Water Wheels*, by placing the shaft in an oblique or leaning direction, called the "Inclined Wheel." And also in the mode or method of making a saw-gate to be applied thereto, or to any other moving power; which is called and denominated the "Centre Sawgate;" Orpheus Thompson, Jericho, Chittenden county, Vermont, December 4.

The shaft of the water wheel is to be inclined so as to form an angle of about 30° with a vertical line. The water is to be shot upon the wheel from a penstock, under an adequate head. It is to strike the periphery of the wheel in a tangential direction, filling the buckets by which it is surrounded, being confined in them by a circular sheathing passing nearly half round the wheel. "The water acts upon the wheel, first by the momentum of its percussive stroke, and then by its gravity upon the inclined plane, having no way to escape until it leaves the wheel on the opposite side."

A vertical or horizontal shaft may receive motion from the oblique, by means of bevel gear.

The saw-gate, as the patentee calls it, is thus formed; there are two levers placed horizontally, with gudgeons in their centres, so as to make their arms equal like those of a scale beam; these are placed one above the other at such distance as is required for the length of a saw. These levers are connected at one end by the saw, working upon pins, and at the other by a screw rod, by which the saw may be tightened, which rod also works upon pins passing through the ends of the lever. A crank, on the end of a horizontal shaft, works a pitman, the upper end of which is attached to the lever.

The patentee "claims as his invention and improvement, the manner of placing the water wheel in its inclined position, and of pitching the water thereon, as the same is herein before described; and also the saw-gate, as the same is made and constructed, and herein before described."

We think that the inventor has proceeded upon the mistaken idea, that power will be gained by the mere lengthening of the levers upon which the water is to act, that is, upon the radii of the wheel. It may be safely put down as a general rule in the construction of water wheels, that where the fall is sufficient to use any other, than an undershot wheel, the height of the head ought not to exceed what is necessary for the filling of the buckets of the wheel, and this will rarely exceed one foot. The whole power of the water is derived from its gravity, and could the whole of this be made to act directly upon the wheel, the more would power be economized. This, however, is not the place to write a treatise on water wheels, and upon this subject, therefore, we will only add, that we are at a loss to perceive wherein the improvement in the proposed arrangement consists.

Saws have been hung in a manner analogous to that described. A patent was obtained for an "Armed Saw-frame," by Mr. Samuel Sperry, on the 18th of June, 1828, which bears much resemblance to it. We apprehend that the wear and friction of so many joints, the difficulty of giving stability to the arms, so as to guide the saw correctly, and the curve in which the saw must work, will not only abstract much from the advantages expected, but prevent the "Centre Saw-gate" from becoming a formidable rival to the old fashioned saw-frame.

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6. For an improvement in the *Manufacture of Cloths;* Isaac P. Hazard, and Rowland G. Hazard, Providence, Rhode Island, December 6.

The specification states that this improvement "consists in doubling and twisting two or more threads of cotton together for warp, and weaving wool on. The advantages of this process are, that a larger quantity of cotton can be combined in the cloth, giving it greater strength and durability."

"We claim as our invention, the manufacture of cloth in the manner above described, by doubling and twisting the warp, instead of using the single one, as commonly done."

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7. For an improvement in the construction and arrangement of the *Machinery for making Screws;* Lemuel W. Wright, a citizen of the United States, but now a resident in London, England, December 6.

The specification of this patent is accompanied by six large sheets filled with drawings of the machinery. Whether or not it is similar to that which has been long in use in this country, we are not able to judge, never having had an opportunity of inspecting the latter, which, we believe, was invented by Mr. Daniel Treadwell, of Boston. This manufactory is still carried on in Pennsylvania. In both, the screws are made from iron wire. We cannot attempt any description, but merely present the claims of the patentee.

"Having thus described both generally and particularly the con-

struction and operation of my improved machinery for making screws, I hereby declare that I do not mean or intend to claim separately as my invention, any of the different parts of which these machines are composed, but I do hereby claim the combination, arrangement, and application of them for the said purpose of making screws in the manner herein described, and particularly,

In the combined means which I have employed for feeding the machines with wire.

In the mode of cutting the wire into proper lengths.

In the manner of giving motion to the punches for heading it.

In the methods of conveying the wire shafts from one part of the machine to another, as for instance, from the first heading dies to the second.

In employing two sets of dies for forming the heads.

In the arrangement and mode of turning and finishing the heads.

In the arrangement and construction of the feeding wheel.

In the manner of notching or slitting of the screw heads.

In the arrangement and construction of the revolving holding chops.

In the method of feeding and actuating the same;—and

In the modes of constructing and mounting the dies by which the thread, or worm, is cut upon the screws."

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8. For an improvement in the mode of making *Snatch Blocks;* J. Evans, Charlestown, Massachusetts, December 6.

The specification states that this improvement in the snatch block consists, "1st. In its being opened at the end by a chain, link, and hook, attached to the strap of the block, instead of a clasp, staple, and pin at the side, as in the old plan."

"2nd. A block on this plan, of equal power with the old, need be but half the bulk and weight."

"3d. The old block is constantly liable to get out of order, for frequently, through neglect, the rope is snatched, and a strain brought on, without the clasp being put over the staple, and pinned; and when this is the case, the block most generally splits, and is thrown out of the strap; whereas, on the improved plan, the block cannot be used until the chain link is hooked, which is done with the greatest ease and facility. It is also frequently the case, that after a heavy strain upon the old snatch block, it is difficult to remove the clasp from the staple; but in the new block, as soon as the strain ceases, the chain link is at liberty."

"4th. The improved snatch block may be strapped with either rope or iron, and can, in either case, be repaired without the aid of fire or forge."

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9. For an improvement in the *Corn Sheller;* Thomas J. Dean, Virgil, Courtland county, New York, December 6.

A conical roller placed horizontally, surrounded by rows of iron pins, or teeth, set spirally, and turned by a crank, on one side.

A piece of plank stands on one side of the cone, and is borne against it by springs. The ears of corn are dropped lengthwise between the roller and moveable plank, the former by its revolution removing the grain. Below this roller there is a fan turned by a strap, for blowing off the chaff, and leaving the grain clean. "The principal advantage of this machine over other inventions, is, that in this the corn and the cobs are effectually separated from each other."

Cylinders with teeth are in common use for shelling corn; the first machine made for this purpose, was, in fact, a toothed cylinder; the conical form presents little or no advantage, as the ears of corn taper but little, and except they were always dropped in the right way, the conical roller would manifestly be injurious. The merit of this patent seems to rest upon the use of the fan, which, had it been deemed necessary for the cleansing of Indian corn when shelling, would, from its constant use for smaller grain, present itself to any one as an appendage.

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10. For *Increasing Water Power*, by atmospheric pressure; Samuel L. Holmes, Bedford, Westchester county, New York, December 8.

(See the specification.)

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11. For an improved machine for *Cutting Dye Woods, &c.* called a "Self-feeding Dye Wood and Tan Bark Cutter;" Aaron Foster, Rochester, Monroe county, New York, December 9.

This machine is constructed as follows. There is a vertical shaft, made to revolve by any suitable means; this shaft is contained within a strong frame, the top and bottom of which receive the gudgeons upon which it turns; near the lower end of the shaft, an iron wheel is firmly fixed; the upper side of this wheel is turned perfectly true and flat, and it is perforated with three, four, or more holes, in which knives, or cutters, are fixed like the irons in a plane. This wheel may be two feet in diameter; at about an inch above it is fixed a stationary table or platform, perforated with holes, just above the line of revolution of the cutters. The ends of the logs to be cut, pass through these holes, and are kept in a position nearly vertical, by troughs or gutters of wood or iron, which stand over these holes. The wood is forced down by weights pressing upon its upper end, and capable of being raised by a crank and pulley.

When tan bark is to be cut, these troughs are made about two feet in height above the face of the machine.

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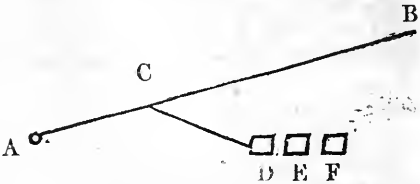
12. For a mode of *Pressing Unburnt Bricks* and tile, by machinery, at one operation, called the "Single Lever Brick Press;" Ephraim Mayo, Hallowell, Kennebeck county, Maine, December 9.

The bed of this machine is a long horizontal frame firmly braced and bolted together; a strong lever, longer than the frame, works

on a fulcrum at one end thereof, the handle part extending beyond the other end, at which the brick is to be pressed. In the accompanying diagram, A, B, is the main lever; at C, a second short lever works upon a joint, and acts upon the follower D. E is the cast-iron mould to contain the brick, and F, the back block. It will be seen that by depressing the lever, the follower will enter the mould, as when the two levers nearly coincide, the power will be very great. There is a counter weight, to sustain or balance that of the lever, and a number of appendages and adjustments which we do not attempt to describe.



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13. For an improved form of *Pump Boxes;* Israel P. Williams and Samuel G. Rea, Salem, Essex county, Massachusetts, December 9.

We are at a loss to discover any novelty in these boxes or valves. If they are not exactly the common puppet valves, they are so much like them, that we think their identity would be sworn to in court. The description given by the patentees is brief, and to us indistinct.

"The box is circular, the valve so constructed as to play with a perpendicular piston, and so graduated in weight as precisely to move without exertion on opening, and fully to prevent loss of water when shut. The box, clapper, or valve, the cross bars, the piston, and, indeed, the whole article is, or may be, composed of the same material; the construction, therefore, from the causes stated, added to which is the fact that neither nails, leather, or other material is used, render the same superior to any heretofore used. The model accompanying, will, we hope, fully explain our wishes."

"And be it further known, that our intention is the application thereof to the use of shipping, and to all other than steam engines, or where hot water is applied."

The material of which the boxes are to be made, is not stated, but in another communication, wood, cast-iron, or composition, are named. Why these valves, when made of metal, are not to be used in steam engines, or where hot water is applied, we know not, particularly as the builders of steam engines have, heretofore, *ab urbe condita,* been in the habit of employing them. The model and drawings exhibit their construction as follows: there is a circular box, or seat, turned conical; into this fits a conical valve, having a tail passing through a hole in a cross bar, to guide it up and down. A staple, or bow, is attached to the valve seat, rising above it, as in the common pump box, for the purpose of removing and replacing it.

Query. Is not this the common conical, or puppet valve?

14. For *Cutting and Preparing Meat for Sausages,* and for stuffing them; Samuel Fahrney, Washington county, Maryland, December 9.

These machines we think very ingenious, and are preparing drawings for the engraver, in order to illustrate them fully.

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15. For sawing and cutting *Felloes for Wheels* of carriages, and other circular work; Samuel Fahrney, Dec. 9.

Several patents have been taken out for machines to saw felloes for wheels. In some of them, two saws are employed, placed at a distance apart equal to the width of the felloe; these are intended to give the proper curvature to the inside and outside of the rim; in general, however, one saw only is used, allowing the imperfection in the curvature to be corrected by dressing. In all of them the plank to be cut is fixed upon the end of an arm, working upon a pin at the opposite end, and capable of adjustment in its length, according to the radius of the wheel; these saws usually work vertically, and the feeding is effected in different ways. In Mr. Fahrney's machine, the saw, with its frame, works horizontally, and the piece to be cut is affixed to an arm which is raised vertically; there is a rag-wheel and feeding hand, in principle like those of the common saw mill. A pinion upon the shaft of the rag-wheel, raises a rack, which pushes against the under side of the arm, bearing the plank to be cut.

Its main features strongly resemble those of several other machines in the office, and we are not aware that the difference in its form includes any superiority in its action.

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16. For a *Washing Machine,* for washing clothes; Eber Blodget, Watervleit, Albany county, New York, December 10.

This machine is a rectangular trough, or box, to contain water. Across the bottom of the trough, are rollers placed near to each other, and nearly touching the bottom. Above this is placed a fluted wash-board, from the centre of which rises a pin or standard, passing into a lever working on a pin on one side of the box, and pushed backward and forward by its opposite extremity; between the rollers and the wash-board, the clothes are to be placed.

"What I claim as new, and as my invention or discovery in the above described machine, and for the use of which I ask an exclusive privilege, is, the manner in which I use the lever power or motion, in operating the two articles, *viz.* the wash-board, and bed of rollers together, so as to wash clothes with ease and facility, without the least injury to the finest cloth," &c.

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17. For an improvement in *Locomotive Engines* or carriages, propelled by steam, on rail, or other roads; William Howard, Esq. United States Civil Engineer, Baltimore, Maryland, December 10.

The engravings are in preparation to publish this patent with three copper plates. They will be ready at an early day.

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18. For an improvement in the *Repairing of Fences;* Edward Pitkin, East Hartford, Hartford county, Connecticut, December 13.

There may be something novel in the subjoined plan of splicing posts, the bottoms of which have rotted off. We, however, have frequently seen the posts both of rail and board fences, spliced at the bottom in a manner so similar to that described and figured in the drawing in the office, that we are unable to tell the difference between the old and the patent mode. That our readers may discover it, we insert the following, which is the whole of the specification.

"This improvement consists in backing or splicing the posts when the bottoms are rotted off. A quarter of a round butt of any tree that is suitable for posts, and about seven feet long, is sawed in a slanting direction, half way across, about 2½ feet from one end, and on the opposite side, the same distance from the other end, and then split apart from one sawing to the other, making two backing pieces with a but to stand in the ground. In case such timber is used as will not split, it may be sawed or hewed into a square shape of about six inches diameter, and sawed diagonally, from about two feet of one end, to about two feet of the other end."

"To repair a post when rotted off at the bottom, the post is raised up and kept in its place, at the height wanted—the backing piece set into the ground so as that the shoulder will be a little out of the ground, and then fastened to the back of the post, by two or more spikes (cut ones preferred.)"

"When a five holed post is rotted off, so as to destroy the bottom hole, the centre of the post may be cut up to the next hole, and a backing piece cut off and slanted so as to fit in, the end coming up so as to form a bottom to the fourth hole, and a spike driven through the sound part of the post on each side, making in this way a four holed post. Posts to fences of all descriptions may be repaired in this way."

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19. For an improved mode of *Propelling Boats* on canals or elsewhere, by steam or other power; Nathaniel Bingham and Pliny Warner, Rochester, Monroe county, New York, December 15.

This is an apparatus for propelling boats by setting poles, working on the bottom of a canal, or other water. The mode proposed, is as follows. Upon the deck of the boat, about midship, or nearer the bows, a beam reaching across from gunwale to gunwale, works upon a pin, or bolt, passing through its centre. A reciprocating motion is given to the "traverse beam," from the piston rod of a steam engine, working horizontally; or from any other motive power.

This traverse beam is connected at each end to sliding pieces which pass along each gunwale to the stern of the boat, and to the ends of these slides, setting poles are attached, which pass down to the bottom of the canal. By giving motion to the traverse beam, these setting poles are alternately brought into action. It is proposed sometimes to have two setting poles on each side. In this case, there will be two sliding pieces along each gunwale, with a pinion between them, working into a rack on each. The effect of this arrangement is apparent. The patentees say: "what we claim as new, and as our invention or discovery, and for which we ask the exclusive privilege, is the peculiar mode of working setting poles by means of the sliding pieces and traverse beam (or by rack and pinions) thus located and arranged, and put in motion by any common machinery now known or used."

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20. For certain *Nostrums for the cure of Gout*, Rheumatism, Dropsy, &c. &c.; Elisha Smith, New York, December 15.

Mr. Smith tells us that he has "invented a sirop, tincture, and external applications, for the cure of gout, rheumatism, *siphilis*, dropsies, and all kinds of ulcers, and all impurities of the blood." But as we have adopted a general rule, which forbids our publishing recipes, or compositions of matter, which are patented, we must leave those unfortunate invalids to their fate, who are labouring under all, or any of the diseases named, or refer them to the "nostrums" of Mr. Smith, namely, his sirop, tincture, and external applications.

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21. For an improvement in the art, or manufacture, or *Construction, of Fences of Iron*, or other metal; Paulus Hedl, New York. Issued, Feb. 21st, 1822. Re-issued, December 18, 1828.

In this specification it is stated that "the improvement in this art for which the said Paulus Hedl claims a patent, consists in the attachment by any convenient means, of a cast-iron ornament, of brass, or composition, or iron, or other metal, to the upper end of wrought iron balusters, sometimes called bannisters, poles, or bars, used in iron, or metallic fences of all kinds." Cast-iron ornaments, it is stated, have been attached to cast-iron posts and columns, but the patentee limits his claim to the attachment of cast ornaments to wrought iron balusters.

We have, certainly, seen vases and other ornaments of cast-iron and of brass, attached to wrought iron fences, in numerous instances, yet this, if we understand the claim of the patentee, is his discovery. Do not the cast brass knobs, and other ornaments of that metal, which have been so long in use, on hand, and other rails, interfere with the claim of this patent, or do we entirely misunderstand it?

For the circumstances under which a patent may be re-issued, see the next article after this list.

22. For a new mode of using the *Hinged Water Wheel;* Matthew D. Brown, Mason county, Virginia, December 19. (See specification.)

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23. For a machine for *Rolling Leather;* Harvey Paign Alexander, Genesee county, New York, December 23.

This machine bears a strong resemblance to some which have been used for rolling pasteboard, and book-binders' boards. A frame is made to swing backwards and forwards upon gudgeons, by which it is hung to two side posts; near the lower end of this frame, there is a "roller of cast-iron, seven inches long, and five inches in diameter, with gudgeons at each end," working in two iron plates. Under this roller, is a piece of timber worked out to the segment of a curve, serving as a bed for the roller. The gudgeons of the frame have some vertical play, to allow for inequalities in the thickness of the leather. A box is attached to the lower part of the frame, to be loaded with weights to any required amount. The leather is placed upon the curved part of the bed, and the frame caused to vibrate by means of a pole attached to the box by a staple. The patentee says,

"The leather is placed on the bench under the roller for the purpose of rolling it. The lathe is moved by the pole attached to the box, by hand, so that the roller moves on the leather to be operated upon, the length of the circle on the bench, compressing the leather in its operation, and making it firm and smooth with great despatch and ease, the labour and time being much less than when performed by hand."

"This inventor claims as his invention, *the utility of the machine*, and particularly the contracting the weights to the centre under the roller, which makes the roller run smooth and equal upon the leather. He also claims as his invention, every part of the machine in every particular, except the roller. The roller has been made and used before the discovery of the subscriber. The other part of the machine has not been known or invented before, to the best of his knowledge or belief."

This invention, or discovery, appears to us to be just such a one as would have been made by any carpenter who had been requested to make a machine for the purpose. We doubt very much the superiority of the box and weight, to the spring pole, which has been frequently used in similar operations. A machine fixed like that for glazing calicoes, with a roller instead of a flint, would, we apprehend, fulfil all the required intentions, without interfering with the broad claim of the patentee, to "every part of the machine in every particular, except the roller."

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24. For a machine for *Cleaning Smut, White Caps, and other impurities from Wheat* and other grain, called the "Vertical Wheel Rubber;" Townsend Carpenter, Elmira, Tioga county, New York, December 24.

A vertical wheel of wood, about 22 inches in diameter, is made to revolve on a shaft by means of a crank. Sixteen pieces of sheet iron cut narrow at one end, and wide at the other, are nailed upon one face of the wheel, so as to radiate from its centre, and reach its periphery, a space being left between each of the pieces equal to about one half their own width. These pieces of iron are punched in the manner of a grater, the rough sides being outward. A stationary plank, similarly covered, stands opposite to the face of the wheel. The grain to be cleaned, is contained in a hopper above, and as the wheel revolves, is rubbed between the two faces, passing out below, where it may be winnowed by a fan wheel placed there for that purpose. There are many parts which we have not attempted to describe, such as a casing for the wheel, regulating screws, &c. but enough has been said to give a general idea of its structure.

Wheat cleaners with cylinders of sheet iron, punched with small holes with the burs outwards, have been constructed, and, we believe, largely used. The general principle of their action is the same with that described, although greatly differing in form.

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25. For an improved *Washing Machine;* Samuel A. Brownson, Montrose, Susquehanna county, Pennsylvania, Dec. 26.

A trough, or box, the ends of which are semicircular, is suspended so as to vibrate upon pins, or gudgeons. The circular part, or bottom, of the interior, has rounds placed near to each other, and passing from end to end of the box; a square hole is left in the cover, to admit the clothes. Two upright posts receive the gudgeons, and sustain the machine. A vertical lever is fastened by a pin, to the lower end of one of the posts, and projects up above the end of the trough. A pin, fastened to a standard on the end of the trough, passes through a mortise, or slot, in the lever, and a vibratory motion is given to the machine by the operation of the hand on the lever. The patentee says, "what I claim as my invention, is, the form of the interior, as specified, and the motion given by the vertical lever."

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26. For an improved method of *Planing, Tongueing, Grooving*, and cutting into mouldings, on either plank, boards, or any other material, and for reducing the same to an equal width and thickness; and also for dressing brick, and cutting mouldings on, or facing metallic, mineral, or other substances; William Woodworth, Hudson, New York, December 27.

The machine for which this patent was obtained, is in actual operation, and executes good work. We have seen a piece of cross grained white pine plank, which had been planed, tongued, and grooved, by it, with a finish which it would have been difficult to have given with the ordinary fore and match planes. It differs essentially from all the planing machines which we have heretofore known. The knives, or cutters, for planing, are arranged so as to form a

cylinder or drum, being attached by their ends to two circular plates. These cylinders are made to revolve with a very rapid motion, the plank, or board, being carried forward by a rack and pinion. Whilst the face is thus planed, a tongue and groove may be cut upon the edges by wheels with cutters projecting from them; the plank is by this process brought to an exact and equal thickness. Circular saws are used to bring the plank to an equal width, or to cut it into strips. Cutters for mouldings, work on the same principle. "Said William Woodworth does not claim the invention of circular saws, or cutter wheels, knowing they have long been in use; but he claims as his invention, the improvement and application of cutter or planing wheels, to planing boards, plank, timber, or other material; also his improved method of cutters for grooving, and tongueing, and cutting mouldings in wood, stone, metal, or other material; and also for facing and dressing brick, as all the wheels may be used single, or separately, for moulding, or any other purpose before indicated. He also claims as his improved method, the application of circular saws, for reducing floor plank and other materials, to a width."

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27. For a process by which the greatest quantity of *Spiritous Liquor, or Whiskey, can be extracted from Indian Corn;* James R. Nance, Floyd county, Indiana, December 27.

This being a recipe, we do not publish it without the approbation of the patentee.

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28. For a mode of *Polishing, Graining, or Dicing, Morocco,* or other leather; and polishing and glazing pasteboard, or other paper, and other fabrics, by machinery, at one operation; Abel Bayrd, South Reading, Mass. December 29.

The patentee refers in his specification, to a machine for a similar purpose, patented by Jacob Perkins, in the year one thousand eight hundred and nine, of which machine he uses certain parts, but in others substitutes improvements of his own, for which the present patent is obtained. A horizontal shaft, revolving between two uprights, carries four, or any other number of arms; on the ends of these arms are affixed the graining, dicing, or polishing balls, or rollers, or blocks, of box, or other material. These are adjusted by screws and slides, and pressed forward by a spiral spring, wound round a cylindrical rod on the arms. A curved table stands under these arms, and upon this is placed the leather to be grained. A brush is affixed to a cross beam, into which the upright posts are mortised; these clean the balls, rollers, or blocks, in every revolution of the arms.

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29. For an improvement in the inflections of the common *Scythe Sneath,* and in the *nibs,* or knobs, and in the mode of *spoting;* Silas Lawson, Sterling, Massachusetts, December 29.

This patent is taken for the particular inflection of the sneath, or

handle, which the patentee prefers, and which he describes and figures. To us it appears perfectly similar to many which we have seen in use; we, however, cannot pretend to judge on so delicate a subject as the proper flexure, and tortuosity, of the ligneous appendage to a scythe. The improvement in the nibs consists in having the sneath well seasoned, and fitting them without wedges. The other improvements we shall not at present attempt to describe, as we should give to this article greater length than it appears to us to demand.

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30. For a mode of preparing *Grooves for Mule Drums,* of tin, copper, or iron, at one operation; John Butterworth, Philadelphia, December 30.

A die, and a forcer, each of cast-iron, eighteen inches long, are formed with fillets and grooves to fit into each other; the strips of tin, or other sheet metal, are pressed between them so as to be raised into the intended shape. These strips are afterwards bent round and soldered on to the drums. The patentee says,

"I claim no more than the dies and forcers as my new and useful improvement. I also claim the application of the said grooves to the tops of card, and drawing pans for machinery, and which I call grooved hoops, or bands."

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31. For an apparatus to *Supersede the use of the Crank* in machinery, called "the Compound Zigzag Screw;" Joseph Woodhull, Rochester, Monroe county, New York, December 31.

The apparatus consists of a cylinder, to which a rotary motion is to be given. A groove is made around this cylinder, or a fillet is formed on it, to which a zigzag, or curved form, may be given. This groove, or fillet, is made to give the desired motion to a lever, or rod, instead of communicating it by a crank. This is what is claimed, and is viewed as "obviating the loss of power in the crank motion, produced by the dead points."

We apprehend that the loss of power by the friction of the grooves or fillets, will far transcend that from the *dead points* of the crank. The latter, indeed, we think in general, is a mere bugbear, as in the greater number of cases where its faults have been attempted to be obviated, it is the best of all possible applications.

In the third volume of the Repertory of Arts, old series, there is a patent, dated 1788, for working pumps, rubbing boards, &c. by means of a cylinder and its appurtenances, (a groove and pin.)

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32. For an improved machine for the purpose of *Locking Wagons;* John Davidson, Brownsville, Fayette county, Pennsylvania, December 31.

This is a friction bar, moved by a rack and pinion, the rack being placed under the centre of the wagon, and made fast either to the coupling pole, or the bed of the wagon: from the pinion an iron

rod projects along to the side of the wagon, and on this there is a crank with which to apply the necessary power.

The description is very general, and affords but an imperfect idea of the plan adopted. Nothing particular is claimed.

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33. For a *Ring Groove Spinner;* John Thorp, Providence, Rhode Island, December 31.

This gentleman has recently obtained several patents for improvements in spinning; we mean to embody, and publish them at a future day.

Information to Patentees,

On the surrendering of a Patent for the purpose of amending the Specification, by the Editor.

It is the practice of the patent office, under a decision to that effect, to admit of the surrender of a patent, by the patentee, should he discover that, through inadvertence, he had not described his invention, or discovery, in those clear and exact terms which the law requires. It is to be understood, however, that the new specification must not include any improvement not intended to have been included in the former; it must only describe it more exactly, and make known more explicitly what the patentee claims as new. The patent of Paulus Hedl, No. 21, in the foregoing list, was thus surrendered. The new patent bears the same date with the former, and the legal fee, thirty dollars, must be paid. The justice of this procedure is manifest, and we think it a great hardship that the practice under the patent law, does not admit of the same justice, when any defect in the claim is discovered in court; in this case, if the patentee enumerates half a dozen points upon which he rests his claim to invention, and one of these is found to be old, the patent is vacated, and the whole is lost to him, whatever may be the real extent of his merits. Had he made the discovery before the validity of his claims had been questioned in court, he might have corrected the procedure, by surrendering his patent; but when the same is discovered by a litigious adversary, and his acute counsel, he has no remedy.

When a patent is surrendered, for the purpose of having it re-issued, it ought to be accompanied by a deed of surrender, to be recorded in the patent office. The subjoined is a good form.

To all persons to whom these presents come, greeting. Whereas, through inadvertence and without any design, the specification of my improvement in [*the machinery for cutting and heading nails at one operation,*] annexed to, and making part of, certain letters patent, issued to me therefor, and bearing date the — day of ——, A. D. ——, and hereunto annexed, is defective; and whereas, in conformity with approved precedent, I am entitled to surrender the said patent, and obtain another for the same improvement, in more full, clear, and exact terms: Now therefore, know ye, that I, A. B., the paten-

tee named in the annexed patent, have surrendered, and do hereby surrender to the government and people of the United States of America, the right and liberty in said patent, to me granted or intended to be granted; and do herewith re-deliver the same to the Secretary of State of the United States, to be cancelled, annulled, and made void.

In testimony whereof, I, the said A. B., have hereunto set my hand and seal, this — day of ——, A. D. ——.

A. B. [L. S.]

In presence of us.
——C. D.
——E. F.

Account of a patent for Manufacturing Glass Knobs for Doors, Drawers, &c., by making them at one operation, without the aid of blowing. Granted to HENRY WHITNEY, *and* ENOCH ROBINSON, *of Cambridge, Massachusetts, Nov. 4th,* 1826.

THE object of making public the claims of a patentee, may frequently be better attained by methodizing and abridging, than by publishing the whole specification. We have given many examples of this, in our exemplified monthly list, and we shall frequently do so with patents of older date.

The improvement in making knobs, consists in pressing them in moulds, which moulds are made in three parts: two of these parts, which form the lower part of the knob, are hinged together, like the ordinary bottle mould, with handles to close and open them, and a clasp to keep them together when closed; this mould reaches as high as the widest part of the knob, and forms the whole of it, excepting the face. This lower mould is left open at top, and is to receive the melted glass from which the knob is to be formed. There is a cylindrical rim, from one-eighth to half an inch in height, projecting or rising above that part of the lower mould which is to give form to the knob. This is for the purpose of receiving and guiding the top part of the mould, which forms the face of the knob.

The top part just fits into this projecting rim, and is cut so as to impress any pattern or device, which may be desired. From the centre of its face proceeds a steel pin, either round or square, and of sufficient length to pass entirely through the knob. The bottom mould has a perforation through the centre, about the size of the pin; this is a receptacle for the surplus glass, which the pin displaces.

When the mould is used, it is placed on a table prepared to receive it. On this table there is a perpendicular standard, with projecting arms, in order to support a lever, and serve as guides to the shank of the upper mould. This part may be called the press.

A rod, or shank, is affixed to the centre of the back part of the upper mould. This rod passes through two guide holes in the arms of the press, which keep it in a vertical position. Upon the end of

this rod, the lever acts in giving an impression on the knob. These arms are made to swivel round, in order to remove the upper mould out of the way, whilst the melted glass is put into the lower; there being a check, to keep it in its proper place, when brought back for use.

By means of a spiral, or other, spring, the lever may be sustained, when not forced down by the hand.

The knob, when taken out of the mould, is "so entirely finished, that it only requires fire polishing, to make it a neat article, fit for immediate use."

The patentees say, "we do not claim to be the original inventors of the mould, as applied to the formation of glass wares, but admit, that for many purposes, it has been heretofore used. Our invention consists in this:—a new combination of the various parts of the mould, with the use of the pin and machinery before described, in such a manner, as without any blowing, to produce a finished knob, with a hole perforated through it, and a nick, or enlargement, so that it will not come out of the mould without opening it, at one operation, by compression merely."

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for a Hinged Water Wheel, granted to Matthew D. Brown, *Mason County, Virginia, Dec.* 19, 1828.

The improvement on the hinged water wheel, is as follows, viz: There are in the first place, sixteen arms inserted into a shaft of the description long since in use, consisting of eight sides, (two arms on each side,) at the usual distance from each end: to every two arms is affixed, by hinges, (or staples used as hinges,) a float or bucket, the breadth of which corresponds with the diameters of the wheel, so as to act freely between the range of arms on each side; one-fourth of each bucket to be beyond, and three-fourths within the hinges, next the shaft when closed; each bucket is bevelled on the outer as well as the inner edge; midway between the extreme arms, are inserted into the shaft, other arms, one on each side, to support the buckets; to each of the arms last mentioned a staple is affixed, for the purpose of fastening the buckets by a hook affixed to each. If deemed necessary, other intermediate arms may be inserted into the shaft, but one set, eight in number, is considered sufficient.

The wheel thus constructed, is susceptible of being used either horizontally or perpendicularly, with or without a dam.

When used horizontally, at a stage of water above the centre of the shaft, the floats are loosened from the arms, and the water is confined in its operation upon the buckets or floats, by being planked over the current in such a way, that the lower edge may be about two-thirds as high as the wheel, and so near to it, as barely to let it have a free and unobstructed revolution; the said planked way rises

with a slope of forty degrees up stream; and a covering of plank is to extend from the top of the former, over the wheel, horizontally.

The advantage of water power, in this position, is considerable, inasmuch as the water is confined to the wheel by the planked covering; and in each revolution, strikes the floats twice; first pressing them (as the wheel revolves,) to the arms, and secondly, throwing them out four degrees beyond a square; and if the water is so high as entirely to cover the wheel, it yet operates in the same way; the water forming an eddy in the upper portion of the wheel, above that part under the first operation of the current. When the water is not above the centre of the wheel, the buckets are to be fastened to their respective intermediate arms. The floats may be rendered strong, by affixing a cross plank or bar to the inner side of each, where it comes in contact with the arms. If the wheel be vertical or perpendicular, two-thirds of its diameter is to be exposed to the current, and one-third to be within the abutment. In this position, also, the water strikes each float twice in each revolution of the wheel, in a manner similar to the former.

The parts, for the improvement of which a patent is now asked, are, the fastening of the buckets to the intermediate arms in time of low water, (when not above the centre of the shaft.)

2ndly. The fastening of the buckets by hinges, at one-fourth from the outer edge.

3d. The buckets opening four degrees past the square, and being twice operated upon in every revolution.

4th. The planking, so as to apply the power of the water to the wheel with greater force.

The wheel improved as aforesaid, is contemplated to propel any machinery whatever, to which water power may be applied.

MATTHEW D. BROWN.

Specification of a patent for a mode of Increasing Water Power by Atmospheric Pressure. Granted to SAMUEL L. HOLMES, *Bedford, West Chester county, New York, December* 8, 1828.

THE mode of increasing water power by atmospheric pressure, is specified and described in the following words, to wit:

Construct a horizontal flue, three feet high by six wide, which is to be introduced at one end, into a dam of only equal height, and sustaining at the opposite end a perpendicular flue, six feet by one foot, raised to any height under thirty feet, and having an opening at bottom into the lower flue, of at least double the dimensions of the throat, for the passage of water upward, with a sliding gate affixed, enclosing the bottom of the upright flue, in order to fill it with water, through a small opening or hole at the top of said perpendicular flue, thus excluding the air.

When both the horizontal and perpendicular flues are filled with water, the hole at the top of the last mentioned flue is secured, the

sliding gate at bottom removed, and the whole is ready for immediate and continued operation.

This application of atmospheric pressure, in the increase of water power for machinery or mechanical purposes, in the mode above described, I claim as my own exclusive invention, and for which, letters patent are here petitioned.

Samuel L. Holmes.

Remarks by the Editor, and by the Patentee.—It is the practice of the superintendent of the patent office, not only to give information to applicants for patents, respecting the operation of the law, and the usage of the office, but also, to remark freely on the correctness of the principles, the utility, or novelty, of the invention upon which the claim to a patent is founded. In conformity with this practice, a letter was written to Mr. Holmes; the purport of this will be manifest from his reply, a portion of which is subjoined. Although we are fully of opinion, that the patentee will find he has been mistaken in his assumptions, yet he writes with so much intelligence, as to prove that his errors are those of a gentleman of excellent understanding, and his opinions are therefore entitled to respect. Instead of giving our own views upon the subject, he shall be heard on his own behalf. We should not presume to publish any extracts from his letter, were we not convinced that our course in so doing, would meet with his entire approbation.

Extracts of a letter from Mr. Samuel L. Holmes.

"It was not, my dear sir, until after a course of careful and repeated experiments, that my own mind admitted the practicability and usefulness of increasing water power by atmospheric pressure. In attempts of this kind, our wishes, I know, are apt to bias our conclusions; and the partialities we entertain for our own ideas or projections, expose us, not a little, to unconscious error and just animadversion. But, in the progress of my investigations on this subject, every objection that presented itself was candidly weighed; for it was evident, if this use of atmospheric pressure could produce no diminution of ordinary labour in effecting the same object; if, after the column were once raised, by filling the perpendicular flue, the pressure of the atmosphere without, would not sustain the column of water within; if the same column, in its discharge, would not continue to be supplied by the same cause; and if the quantity of that discharge would not be in proportion to the height of that column, this application of the principle would, of course, be altogether futile: but if, by atmospheric pressure alone, unaided by any operative machinery, or by any manual labour, except in the mere filling of the perpendicular flue in the first instance, all these points could be gained, then, the feasibility and importance of the object proposed could no longer be doubted. Thus have I thought, and thus reasoned; and the result of my experiments has been, a sincere convic-

tion of having attained my end, and of having taken nothing for granted, but what fact justified, and science established."

"This statement is due to you, sir, and it is equally due to myself, in vindication of the step taken, in troubling your department for a patent."

"I would now beg leave, and your friendly letter evidently invites me, to enter a little more into detail, on this subject. In the course of some instruction, which, as principal of the academy in this place, I was, several months since, giving to a pupil, on the construction and use of the barometer, the inquiry was suggested to my own mind, whether the fluid, thus sustained by the outward pressure of the air, could be made to discharge underneath the same column, and be applied, with the weight of its own perpendicular pressure superadded to that of the same fluid, on whose surface the upright column was raised; and whether, as this column discharged, it would continue to be supplied, by the same sustaining cause."

"My first experiment was made with what I have called a horizontal and a perpendicular flue; the former open, the latter closed, except at the bottom, on one side of which an opening was likewise left, below the surface of the water in the lower flue, for the free admission of water into the upper flue. The perpendicular flue, filled with water to exclude the air, and thus introduced into the horizontal flue, also filled with water, was erected directly over a closed orifice or throat, at one end of the last mentioned flue. On opening this throat, the water was found to discharge freely, without admitting air into the upright flue; the elevated column continued to be sustained, and the requisite supply to be readily furnished, by the pressure of the atmosphere alone. Several other experiments were made, unimportant in their results; but doubts were still to be removed. It was true, the water discharged, without interruption, at any point below its natural level; the column was faithfully sustained, and the supply furnished; but, did the discharge proceed in part from the elevated column, or was it produced only by the water in the horizontal flue, while the water in the column above it continued not only to be supported, but to be retained there, by atmospheric pressure? To ascertain this point, I had a perpendicular flue constructed, with a partition in the middle, at the bottom, extending above the surface of the water in the lower flue, so as to cut off all connexion between this flue and the throat. The result was precisely the same. The water discharged with the same freedom; the column was still sustained, and the supply afforded as readily as before. One doubt, however, yet remained. Did this column discharge, in force and quantity proportional to its height? This last doubt was satisfactorily removed, by repeatedly ascertaining, that, within a given time, a much greater quantity would be discharged, through the same orifice, *with* the column, than *without* it. Now, in regard to water, quantity, if properly applied, is power. If, then, by atmospheric pressure, a far greater quantity of water, within a given time, can be similarly applied, where a less quantity only could be otherwise employed, water power may be most essentially

increased, without labour, by the simple application of this principle alone."

"This, sir, is my honest conviction; but, though it be the result of cautious and persevering research, yet, it will not justify me in saying, I may not be in error, so long as the decision of your better judgment stands against me."

Specification of a patent for an improvement in the art of manufacturing all articles formed by Pressing Melted Glass into Moulds. Granted to DEMING JARVES, *Boston, Massachusetts, December 1st,* 1828.

To make articles of pressed glass, by the method in which they now are, and heretofore have been manufactured, a mould, giving the *shape* and ornamental impressions, has been required for *each* article manufactured; and the shape of the article or vessel intended to be made, is preserved during the cooling of the metal, in a receiver of like shape as the mould, and thus the manufacturer is obliged to possess and use, a *mould* and *receiver* for *each* article, of different size and shape, which he makes.

The improvement for which I ask an exclusive privilege, consists in pressing all the glass, intended for the various articles and vessels to be manufactured, into sheets by a mould, which impresses upon the sheet of glass, all the ornamental figures intended for the article or vessel to be made. I thus obtain, by the use of *one* mould, sheets of ornamented glass, and out of these sheets the article to be manufactured, as to *size*, shape, and figure, is to be produced by receivers of the size, shape, and figure required. The sheets of glass, (being impressed as aforesaid,) are placed upon the receiver, in so heated a condition, as to sink or settle into the receiver, and thus acquire its particular form and figure; and, should these sheets become too cool to settle readily into all the slopes and angles, and take the true shape and figure of the receiver, a *follower* of same shape with the receiver, is used to force the metal into all the parts of the receiver. Any excess of glass is removed, or cut, from the edges of the receiver in the usual manner.

DEMING JARVES.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Observations on the Measure of Impact.

OF the various modes of applying power in mechanical operations, there is, perhaps, none so simple nor so much in use, as that of impact, or percussion; and yet. there is probably none, the measure of which is so little understood.

Either of the *mechanical powers*, technically so called, may be so applied, as to produce and maintain any intensity of pressure through any length of time, without the least expenditure of force: hence they are each susceptible of comparison with the power of a dead weight at rest. And it appears, that philosophers and mathematicians had, for a long time, puzzled themselves with fruitless attempts to institute a similar comparison, in relation to the force of impact. But as impact necessarily implies an absolute development and expenditure of mechanical force, and a weight at rest expends no force, the idea of comparing them was at length found to be an absurdity. This discovery, however, so far as I have been able to ascertain, has not been followed by the substitution of any other standard of comparison, by which to estimate the power in question.

Having recently had particular occasion for such an estimate, I was compelled, *ex necessitate*, to attempt a solution of the difficulty myself. The result is so simple as to make me doubt its novelty—but, whether new or old, I presume that to many of the readers of the Journal of the Institute, it may prove serviceable.

It is known that the momentum, acquired by a heavy body or weight, in falling through a given distance, constitutes a power precisely equivalent to the raising of the same weight through the same distance, or to the raising of any weight through any distance, provided the product of the weight and distance be, in each case, the same. For the terms *raising a weight*, may be substituted the terms *overcoming a resistance.* Connect with this, the consideration of the distance through which the resistance is overcome; and, though it may make more rhymes than we like, it may furnish us with a fit subject of comparison, with the force of impact. In most of the processes in which this force is employed, the intensity of the resistance varies, in some instances regularly, and in others irregularly, while yielding to the blow—but, to embrace an estimate of the effect of such variations, would render our calculations more extensive and complex, than the present purpose of illustration requires. In the following examples, therefore, the resistance is assumed to be uniform.

Example I.—If a pile driver of 500lbs. weight, with a fall of 20 feet, sinks the pile 1 foot, what was the resistance?

As 1 foot : 500 lbs. : : 20 feet : the answer 10,000 lbs.

Example II.—If a weight of 100,000 lbs. is found just sufficient to overcome the resistance to the sinking of a pile, what weight, falling 20 feet, will sink the pile 9 inches?

As 20 feet : 100,000 lbs. : : 9 inches : the answer 3750 lbs.

Example III.—From what height must a weight of 1200 lbs. fall, to drive a pile 3 inches against a resistance of 150,000 lbs.?

As 1200 lbs. : 3 inches : : 150,000 lbs. : to the answer $31\frac{1}{4}$ feet.

In piercing metallic plates by means of a punch and die, there is a still more astonishing exhibition of the immense resistance which is overcome by impact, through minute distances.

Example IV.—If a weight of 100 lbs. falls 10 feet, what resistance is it capable of overcoming through a distance of $\frac{1}{10}$th of an inch—that is, the thickness of the plate?

As $\frac{1}{10}$ inch : 100 lbs. : : 10 feet : the answer 120,000 lbs.

But if the metallic sheet to be pierced is $\frac{1}{200}$ part of an inch thick; then a weight of 100 lbs. falling 10 feet, would be capable of driving before it through that minute distance, a resistance of more than *one thousand tons.*

To calculate the force usually applied by the hammer, mallet, &c. used by hand, would require a more precise estimate of their velocity than I can at present furnish. This should be ascertained by experiment; and the result, I doubt not, would astonish the most experienced workman.

CARLOS.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Description of a Condenser and Refrigerator, intended as a substitute for a Worm in Distilleries, the Cooler in Breweries, and the Condenser in Steam Engines; By BENJAMIN F. JOSLIN, M. D., *Professor of Mathematics and Natural Philosophy, in Union College, Schenectady, N. Y.*

THIS apparatus *consists essentially of two contiguous laminated and convoluted cavities*, through one of which the refrigerant fluid circulates, and through the other, the calorific, in the *opposite* direction, communicating its heat to the former, through the medium of a thin lamina of metal. The usual method of constructing it, is to unite by hard solder, several sheets of copper, so as to form one long rectangular sheet. This is folded in the middle, and the two equal and similar halves rolled up together, commencing at their line of junction. They are, either previously or subsequently, separated by the interposition of slips of lead, to the distance of from one-sixth to one-half of an inch, according to the intended magnitude or use of the apparatus. With this lead, together with the solder, some, or all, of the four spiral edges of the two laminated spaces, as well as their outer extremities, are closed. When, for facilitating inspection, purification, or repairs, the spiral opening is left unclosed, at either the upper or lower end of the apparatus, it is temporarily closed by a flat plate. In forming these cavities, the interior and exterior extremities of each, are dilated into a cylindrical form, for the reception of four pipes, to give admission and exit to the calorific and refrigerant fluids. The above apparatus unites, in a higher degree than any hitherto employed for similar purposes, the properties of *simplicity*, *cheapness*, *compactness*, and *refrigerant power*. One of them, which occupies but the space of a cubic foot, condenses and cools a gallon of spirits per minute. No tub is required for its immersion. With an ample supply of water, the effect would be much greater than that above stated; for owing to the thinness of the passages, their correspondence in form and direction, and the great number of convolutions of which they are susceptible in a given space,

any requisite velocity may be given to the refrigerant liquid, without disturbing the regular progression of those opposite series of temperature, which exist in the adjacent coils, or permitting the particles of the two fluids to escape mutual influence; an advantage which, for obvious reasons, it is impossible to realize with the common worm.

The inventor of the above described apparatus, obtained his first *patent* for the essential parts of the same in 1824; Yandal's refrigerator, remotely allied to it in principle, was patented in Great Britain in 1826 and 7; and though considered a valuable invention, it omits some of the most important features, and possesses only *one-third* of the refrigerating power of the American apparatus, as can be easily demonstrated. A bare inspection of the drawings of both will show, that only one out of the three laminæ of the former is employed in transferring caloric, whilst in the latter, the *whole* metallic *surface* may be rendered effective. Moreover, the two fluid laminæ being subjected to each other's influence, on both sides instead of one, the effect will be equal with a double width of the channels, and with an equal width, greater from this cause alone, than in the European apparatus. The access which may, (from the facility of applying a cover,) be afforded to the interior, and which is done in the latter modifications by the inventor, also gives it a great advantage for some purposes, as in the manufacture of beer; where a glutinous substance adheres to the inner surface, which, in this apparatus may be effectually removed, by the introduction of an instrument resembling a spatula or a small spade, covered with some elastic substance. As a refrigerator for worts, this occupies about the one five hundredth part as much space in the building, as the ordinary cooler; and in warm weather especially, reduces the worts to a lower temperature, and in a shorter time, and always *without* the *least exposure* to *atmospheric air.*

Do not theory and experience concur in showing, that the worts are frequently injured by the atmospheric oxygen, so extensively applied in the ordinary mode of cooling?

It would be easy to point out numerous useful applications of this invention; as the heating of mash in distilleries, salt water in the manufacture of muriate of soda, water for steam boilers, and air for various purposes.

The aggregate, as well as internal form of the apparatus, the arrangement of its passages, and the relatively small extent of its external, compared with its internal surface, give it an unparalleled power of insulating the temperature of its contents, with little loss, by conduction and radiation. This property not only increases its value in its application to some of the useful arts, but also renders it an important instrument, for many experimental researches on caloric, and especially for determining the specific heat of liquids, vapours and gasses. Perhaps this may be the subject of some future communication.

Remarks by the Editor.—We were particularly pleased with the principle of Yandal's apparatus for cooling worts and other fluids,

which was the subject of a patent in England, and was published in this Journal, vol. 4. p. 184. We were not then aware that the merit of the original invention belonged to our own country, and, was the property of Professor Joslin. Yandal's patent was sealed August 24th, 1826, and enrolled February, 1827. The foregoing article, referring back to the records of the United States' Patent Office, to the year 1824, plainly puts this question at rest.

A second patent, for a very similar apparatus, was obtained in England, by Robert Wheeler, a Brewer; his patent was sealed in November, 1827, and enrolled in May, 1828. The patentee calls it "*Archimedes' Condenser or Refrigerator;* the peculiar novelty of which, consists in forming the chambers for the passage of the fluids in spiral channels, winding round a central tube, through which spiral channels the hot and cold fluids are to be passed in opposite directions."

This, like Yandal's, it is proposed to use as a condenser for stills, and for other purposes. It appears, indeed, to be the same thing, varied in form only, and, although it might possibly be sustained as different, according to the practice under the English law, we are convinced, that with us they would be considered as identical. Our concern, however, does not relate to this point, but to the fact, that the invention is American; and, although it is very possible that it may have been invented in England also, it is much more probable that it was taken either from New York, or from the United States' Patent Office, as has been the case with *many* other inventions, which have been patented in England.

We have seen many certificates of the value of Professor Joslin's apparatus; from these we give some extracts, as they may serve to make a valuable invention more extensively known.

"Joslin's patent Condenser succeeds well, and I believe it to be a very useful invention.

WILLIAM THOMPSON, Superintendent of a distillery.
Lenox, Madison county, New York, Sept. 8th, 1826."

"Manlius, September 14th, 1826.—The Condenser put up in my distillery by Dr. Benjamin F. Joslin, is yet in successful operation; and the longer I use it, the more perfectly I am convinced of the great importance of the invention. ORLANDO SMITH."

Under date of September 19th, 1826, HENRY POLHEMUS, of Auburn, states, that the Condenser "makes twenty degrees difference in the temperature of the spirits."

Several others of subsequent date might be given, but as they are to the same effect, we add the following only, from a brewer.

"New York, April 12th, 1828.—Having one of Professor Joslin's refrigerators in operation in my brewery, in this city, I am satisfied that it is a very valuable invention for cooling Worts, and far superior to any other with which I am acquainted.

HENRY BUNCE."

Reply to two Queries in the last number of the Journal of the Franklin Institute, respecting the comparative effect and value of different falls of Water.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—In No. 2, Vol. 3, of your Journal, a subscriber propounds the following queries, viz.

1st. How many inches of water under 15 feet fall will produce the same effect as 100 inches under a 20 feet fall, both acting on overshot wheels under a 3 feet head?

2nd. Suppose 100 inches of water of 20 feet 6 inches fall, be received at 600 dollars per annum, what will be the value of 100 inches, the fall being 9 feet 8 inches, the situation being otherwise equal?

To which it is believed the following observations are applicable.

The power of water, to produce mechanical effect, is as its perpendicular fall, the true measure of which is found by multiplying its weight by its fall; but the best devised modes of applying it will not produce equal effects in equal portions of its fall. For example, take the circumstances of query 1st, the fall 20 feet, acting under 3 feet head, which for convenience I shall divide into 3 feet head and 17 feet fall.

It has been found that the greatest effect, in relation to the power of water acting by gravity on a wheel, is as 8 is to 10, and that the head, or that portion of the descent from the surface of the water in the reservoir to the point where it impinges on the wheel, is as 1 is to 7. (See Smeaton's Experimental Inquiry, pages 31 and 32.) By applying these data to the circumstances of query 1st, we have the following calculations and results.

Suppose 100 tons of water to descend from the reservoir to the

top of the wheel 36 inches × 100 = 3600 power, the effect will be as 1 to 7,	= 514.28
Descent on the wheel 17 feet = 204 inches × 100 = 20400 power, the effect will be as 8 to 10,	= 16320.
Effect of 100 tons of water under 20 feet fall,	16834.28

To find the effect under 15 feet fall, divided into 3 feet head and 12 feet fall.

Head 36 inches × 100 = 3600 power, the effect is as 1 to 7,	= 514.28
Fall, 144 inches × 100 = 14400 power, the effect as 8 to 10,	= 11520.
Effects of 100 tons under 15 feet fall,	12034.28

Effect. *Inches.*

As 16834.28 : 100 : : 12034.28 : 139.9 inches, answer to query 1st.

Query 2nd. The annual value of 9 feet 8 inches fall, compared with 20 feet 6 inches fall, will depend in some measure on the method of

its application. The results of three different modifications are exhibited in the annexed calculations.

1st, 20 feet 6 inches head and fall to be applied to an overshot wheel under 3 feet head.

Suppose 100 tons of water to descend from the reservoir to the top of the wheel, 36 inches × 100 = 3600 power, the effect as 1 to 7, } = 514.28

Descent on the wheel 210 inches × 100 = 21000, effect as 8 to 10, } = 16800.

Effect of 20 feet 6 inches fall, 17314.28

9 feet 8 inches fall, to be applied to an overshot wheel under 3 feet head.

Head 36 inches × 100 = 3600 power, the effect as 1 to 7, } = 514.28

Fall, 80 inches × 100 = 8000 power, the effect as 8 to 10, } = 6400.

Effect of 9 feet 8 inches fall, on an overshot wheel, 6914.28

2nd. If 9 feet 8 inches fall be applied to a wheel 14 feet diameter under 3 feet head, that is, with the gate 4 inches below its horizontal centre, it is believed that the best method of applying the water, is, to direct it in a tangent to that point of the wheel where the bucket shall receive it, which will be (if the opening shall be 2 inches wide,) about 18 inches below the gate; the impinging point will then be at the bottom of the bucket, 14 inches below, (if that be the depth of the bucket.) Thus arranged, the head and fall will be,

From the top of the water to the gate,	36 inches.
From the gate to the receiving point,	18
From the receiving to the impinging point,	14
	68 head.
From the impinging point to bottom of wheel,	48 fall.
Head and fall,	116

Effect of the head relative to the power in this last arrangement will be as 1 is to 6.

Suppose 100 tons of water descend to the impinging point 68 inches × 100 = 6800, the effect as 1 to 6 = 1133.33

Descent on the wheel 48 inches × 100 = 4800, the effect as 8 to 10 = 3840.

4973.33

3d. The same as 2nd, with centre buckets in place of close buckets, 14 inches deep. In this case the impinging point will be 18 inches below the gate.

Head and fall thus: to the gate,	36 inches.
From the gate to the impinging point,	18
	54 head.
From the last point to the bottom of the wheel,	62 fall.

100 tons $\times$ 54 = 5400 power, the effect as 1 to 6 = 900
100 tons $\times$ 63 = 6200 power, the effect as 8 to 10 = 4960

Effect of 9 feet 8 inches fall on breast wheel with centre buckets, 5860

As 17314.28 : 600 dollars : : 6914.28 : $233.83, value of 9 feet 8 inches fall, overshot.

As 17314.28 : 600 dollars : : 4973.33 : $172.35, value of breast, buckets 14 inches deep.

As 17314.28 : 600 dollars : : 5860 : $203.7, value of centre buckets.

The depth of the shrouding is always lost from the fall on overshot wheels, and as the loss is greater in proportion on small than on large wheels, (unless the shrouding be narrower in proportion as the wheel is smaller,) the 6 feet 8 inch wheel will fall something short of the result assigned to it in the calculation. ANOTHER SUBSCRIBER.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Remarks on Arnott's Elements of Physics. By a Correspondent.

THE "Elements of Physics, or Natural Philosophy, General and Medical," lately republished by Messrs. Carey, Lea & Carey, under the editorship of Dr. Hays, is a treatise well fitted to serve the purposes of those who have not leisure to peruse works constructed on the plan of rigorous demonstration. To many readers, a knowledge of leading facts and general principles, is more interesting than purely scientific discussions. Conversation, even in mixed assemblies, often turns on these great outlines of science. For the purposes of general society, therefore, their acquisition must be rendered as easy as possible. At the same time, then, that we should deprecate the substitution of vague, discursive *reading*, for diligent *study*, in the physico-mathematical sciences, among the classes of our various seminaries, we ought to rejoice at every effort which makes those sciences accessible and available to the mass of mankind. To this end are directed the establishment of public lectures, the publication of popular treatises, the institution of practical schools, and the circulation of journals for the dissemination of useful knowledge.

The medical profession of our country will be under particular obligations for the republication of this interesting volume. The word *physician*, as generally applied, has often proved a curious misnomer, in being appropriated to those who have no knowledge of "physics;" *luceas a non lucendo*, and *doctor* a non docendo, or *a non docto.*

Dr. Arnott's division of his work, is, on the whole, judicious; his facts and illustrations well selected; his explanations simple and intelligible, and his style lucid and familiar.

His *method* of presenting the several subjects, might, perhaps, be improved by placing his general statements on what he calls the "analyses," at the *end*, instead of the *beginning* of his sections, and

the separate propositions as *results*, not as *foundations* of his facts, experiments, and particular illustrations.

It seems strange to suppose that the student will understand an analysis, or abstract expression, before he has in mind any of the facts on which it is grounded; yet such is the perversity of the antiquated method of instruction, from which the author has not been able wholly to free himself. The American editor has partly obviated this objection, by adding to each of the first two sections, an appendix, containing all the important general truths which have been exhibited in the course of the section; and in one or two instances has departed so far from the professed design of Arnott in excluding "technical mathematics," as to introduce the *abstract* or *algebraical*, as well as the general expressions of the principles under discussion. This appears to be the true course of instruction, and if the work arrive at a second edition, it is to be hoped the same course will be pursued with respect to all parts of the book.

Dr. Hays has, likewise, added a few notes, particularly relating to the *medical* department of the subject, which will be found useful to men of that profession. J.

Franklin Institute.

Extract from the Report of the Committee appointed by the Board of Managers of the Franklin Institute, to view Mr. Isaac Macauley's *Floor Cloth Manufactory.*

The committee state that they were appointed by the preceding Board, at the instance of Mr. Macauley, to view his establishment at Bush Hill, in consequence of attempts having been made to influence public opinion unfavourably towards his manufactory, by drawing unfair comparisons between it and the foreign fabric.

"One of the leading objects of this institution, has been that of introducing the consumer to the producer; and while they would decline any interference between rival manufactures of our own country, the Board deem it entirely within the spirit of their duty, to allay, if possible, any prejudice that may exist against our own products, where the foreign comes in competition, and wherever the former is worthy of protection. Under these views the committee was appointed with instructions to wait on that gentleman, which they have done.

"Mr. Macauley afforded them an opportunity of viewing his extensive and interesting Manufactory throughout, and observing the operations in all their details. They, therefore, have no hesitation in risking their reputations for judgment in this article, by giving their opinion, that the oil cloths of all descriptions made by him, were equal to any they have ever seen, and presented great evidence of the improvement made in this manufactory, since it has been in Mr. Macauley's hands.

"The large floor cloths, which the committee first examined, are made from flax or hemp, and wove in pieces of 21 feet wide, and 60 feet long, (making 140 square-yards in each piece, without seam.) When finished, they are suspended the above size, in a drying house, an edifice admirably contrived for the purpose, where they gradually harden, until they are fit for use, which, we were informed, required at least twelve months. Of this, the committee could have no doubt, as they found from 14 to 15,000 yards, finished in a handsome style, most of which have been there more than a year. On examination, they were found to be strong, very hard, well filled with paint and varnish of the best quality, and exhibited no tendency to peel off, or stick. The patterns are well selected, to imitate Brussels and other carpeting, colours rich and bright.

"In the fabrication of lighter cloths, for covering tables, &c. Mr. M. has been eminently successful. In the large quantity of 15 or 20,000 yds. suspended in various parts of the premises, the committee saw none which would not do credit to any maker. They were well made and elastic. The fabric is of cotton, covered with gum elastic, and other varnishes, (for which improvement, Mr. Macauley has obtained a patent,) without any of the crumbling mixture so often found in German cloths. The surfaces were smooth, and beautifully figured and bordered, in all widths from 2-3ds to 6-4ths.

"We understand, that by the introduction of labour saving machinery, he is enabled to reduce the prices of his cloth, and at the same time, maintain its reputation for good quality, offering them for sale at a reduction of 10 to 12½ per cent.

James Ronaldson, Chairman.

"*Philadelphia, February 10th*, 1829."

Proposals for a series of Experiments on the effect of water on wheels of different kinds, to be undertaken by the Franklin Institute.

To Correspondents.

At a meeting of the board of managers of the Franklin Institute of the State of Pennsylvania for the promotion of the mechanic arts, held March 12, 1829, the following resolutions were proposed and adopted, viz.

Whereas, the value of water, as a moving power, and the relative effects produced by it upon wheels of different constructions, have never been fixed by actual experiments, on a scale of sufficient magnitude to settle the principles upon which it is to be calculated; and whereas, a course of experiments of sufficient magnitude, to fix the data from which such calculations may be made with accuracy, would be of great value to every one interested in mill work; therefore,

Resolved, that it is expedient for the Franklin Institute to undertake a series of experiments, for the purposes set forth in the above preamble, provided sufficient funds can be obtained for the purpose.

Resolved, that a committee of inquiry be appointed, with instructions to apply to the select and common councils of Philadelphia,

for the use of part of the city water works, and water from the dam at Fair Mount, for the purpose of prosecuting such experiments.

Resolved, that said committee be authorized to solicit funds from such as may be interested in these experiments, to aid in carrying them into effect:—Whereupon, Messrs. S. V. Merrick, Benjamin Reeves, Isaiah Lukens, Rufus Tyler, and Andrew Young, were appointed on said committee. Extract from the minutes.

William Hamilton, Actuary.

By the annexed preamble and resolutions, it will be seen, that the Franklin Institute have it in contemplation to conduct a course of experiments on the value of water power, and a comparison between the different constructions of the water wheel, with a view of establishing principles sufficiently accurate for the basis of the millwright's calculations. So soon as the necessary preliminary steps are taken, and the funds are obtained, (the estimated expense to be obtained by subscription is $2000,) a commission will be appointed of gentlemen conversant with the subject.

The want of such a course of experiments has long been felt, and the great expense attending them, has debarred individuals from making the attempt. The funds of the Institute are not adequate to it from their usual resources, and they are reluctantly compelled to call upon those interested for assistance, which they are confident will not be withheld. Through the liberality of the city councils, they are enabled to conduct them in a situation highly favourable, the Fair Mount water works, under an 8 feet head and fall, where the water expended and effect produced, can be accurately estimated.

To enable the committee to enter upon the discharge of their duties under every advantage, correspondents are requested to furnish the editor of this Journal with such information as their ingenuity or practice may suggest, and which may aid them in deciding on the best manner of conducting the experiments.

The experience of practical men on the best mode of applying water to a wheel, form of buckets, manner of ascertaining its effects, with proper diagrams, will be particularly acceptable.

A report of all the experiments made by the committee, with their results, will be published in this Journal, when completed; and the Institute is desirous that the grounds of their proceeding may be as public as their report, to enable practical men to detect any defects in operation. Communications may be sent by mail to the editor; donations of those who feel disposed to aid the Institution in their exertions, to the actuary, or either of the undersigned.

Samuel V. Merrick,
Benjamin Reeves,
Isaiah Lukens,
Rufus Tyler,
Andrew Young,
} Committee of Inquiry.

Protection against Damp, Rust, &c. By John Murray, F. S. A., F. L. S., &c.

I find that if linen or woollen cloth be immersed in water, saturated with *quick-lime and sulphate of soda*, and then carefully dried, delicate steel instruments folded up in it, even if themselves damp, are effectually preserved from rust or oxidation. The rust of iron is found to contain a carbonate of that metal, and the aqueous particles of "wet," and "damp," are, it is proved, decomposed by the contact of iron at all temperatures, and with increased effect at an elevated one; hence, the formation of rust, or oxidation, &c. It is probable that the caustic lime not merely absorbs any minute quantity of carbonic acid present in the air, and by damp brought into more immediate contact with the iron or steel, but also absorbs the first portions of present damp; perhaps, too, caustic lime may even take up *oxygen*.

The efflorescent sulphate of soda does not attract humidity, but rather casts it off, parting even with its own water of crystallization.

It is evident that an envelope of cotton or woollen cloth, saturated as described, would not only be a protection against damp in the case of steel, plate, &c., but also of equal value for the preservation of deeds, &c., whether on paper or parchment.

Steel articles, &c. may be very well preserved, if buried in powdered quick-lime.

From a number of experiments I have made by suspending, by means of a silk, &c. thread, finely polished and magnetized steel bars in *lime water*, so as to float freely in this medium, from the point of suspension, I have concluded that it points out an admirable method by which the magnetic virtue may be preserved for an indefinite period. A ring of iron, inclining to the "angle of no attraction," pointed out in Mr. Barlow's Researches, might surround the phial or little glass globe, and the cardinal points be engraved by a diamond on a circular line, externally. Under these circumstances, poised in a uniform medium of unvarying density, no atmospheric mutations would disturb it, and the finely polished steel needle would be preserved even free from oxidation, the fatal antagonist to magnetism.

On the relative quantity of Steam condensed in vessels with bright metallic and blackened surfaces. By R. W. Fox, Esq. Vice President of the Royal Geological Society of Cornwall.

Two cubical vessels of tin plate, of which the surface of one was bright, and that of the other covered with lamp-black, were connected with a steam boiler, by tubes so inclined towards the latter, as to allow all water resulting from condensation in the tubes, to return to it. The vessels were of equal dimensions, four inches side, and

the experiment was made in a close room, of which the temperature was 82°; that of the steam being at a mean of 215°. The water was withdrawn by cocks properly adjusted for the purpose; and at the expiration of seventy-two minutes, the bright vessel had afforded 5.7, and the blackened one 10.2 cubic inches. Now, supposing steam of this temperature to be 1600 times rarer than water, in 24 hours the condensation from one foot of blackened surface would be 489,600 cubic inches, or 1736 gallons of steam, and from an equal extent of bright metallic surface 273,600 cubic inches, or 972 gallons. Hence, the condensing energies of a blackened and polished metallic surface were to one another as 1736 is to 972. When the difference between the temperature of the heated body and that of the surrounding medium is greater, the effect will be proportionally augmented.

But when currents obtain, it is probable that the effect will be increased in both; but that the ratio of this increase will be greater for the bright, than for the blackened surface.

[*Brewster's Journal.*

Polytechnic Society of Frankfort.

The Polytechnic Society of Frankfort on the Maine, for the promotion of the useful arts, and the sciences connected with them, was instituted in 1816. It is composed of members taken from every class of citizens, particularly amongst artizans. Mutual instruction in mechanics, the useful arts, and the sciences connected with those arts, forms the principal object of the Society. In order not to interrupt the weekly labours of the workmen, a Sunday class has been established purposely for them since 1818, which is in the most prosperous condition. The committee of management of this institution, have added to the plan, a saving bank for its members, and an annual exhibition of the produce of industry and the arts. The funds of the saving bank in question, amounted in the first five years to nearly half a million florins, proceeding from 2,500 deposits. The annual exhibitions have also been successful.

Dr. Granville's Travels.

LIST OF FRENCH PATENTS

Granted in the first quarter of the year 1828.

Sequin, letter press printer, Paris, for manufacturing china pasteboards—5 years.

Claude Pierre Roux, jeweller and gilder, Paris, for a mechanical frame, called a *pendule*—5 years.

Pierre Jeandeau, Knight of the Legion of Honour, Director of the Works of the Royal School of Arts and Trades, at Châlons, for

a machine for throwing up a continued steam, suited for draining—10 years.

John Nicholson, Paris, engineer, for a process, apparatus, and machinery for preparing and printing the threads of flax, cotton, silk, &c.—15 years.

Claude Jean Baptiste Alexander Berthault, Surveyor of Roads, Châlons, for a process for making a water-proof cement—15 years.

Victor Lemétayer, manufacturer, Fécamp, for a warping machine—10 years.

Pierre Bouillon, junior, Limoges, for a system of steam engines of all pressures—10 years.

Auguste de Boussard, clock-maker, Toulouse, for a superior self-cleansing level lamp—10 years.

Francois Chatelard and Petrus Perrin, steel comb makers, Lyons, for a comb of a new form, adapted to broad cloths—5 years.

Delamnay, surgeon, Nantes, for an instrument of a particular form for midwifery—5 years.

Jacques Nicholas Legendre, Ecquainville, for a mechanical mode of making barrels, tubs, &c.—15 years.

Jean Pierre Praget, Ais, brazier, for a still—10 years.

William Kinner Marshal, London, for a new method of mounting cannon—10 years.

Hemsteller and Rieger Bommer, Vassellonne, for a new method of making roads—10 years.

Jacques Javel, junior, one of the Proprietors of the *Messageries Royales*, Paris, for the construction of a carriage for transporting goods and passengers with expedition—15 years.

Louis Aubry, merchant, Chaumont, for a machine for sowing by back-stitch and quilting, called the *Métier Régulateur*—5 years.

Dumont, refiner, Paris, for a method of baking, clarifying, and filtering sugar—10 years.

Alexander Derlin, Paris, for the application of hydrogen gas to lamps with a double current of air, serving as an impellant and burner—15 years.

Daniel Girand, Paris, for a method of using the "*filvire*," invented by Caiman Duverger—5 years.

Paul Portal & Co., Bordeaux, merchants, for a steam engine with Gurney's high pressure—15 years.

Bertrand Fourmond, engineer, Nantes, for a printing press, with jointed movements, by means of a lever, called the *Presse Nansaise*—5 years.

Dr. Barrier, Lavoulte, for a pneumatic hydraulic machine—15 years.

Michel Oddo, mechanician, Marseilles, for a method of preventing smoky chimneys—5 years.

Joseph Guyon, Dole, for the construction of an economical kitchen furnace—10 years.

Pierre Agathe Mostier and Jean Baptiste Bourgen, mechanics, St. Etienne, for a process of making wide ribands on looms *a la Zusichoise*—5 years.

Henri-Joseph Pohlen, Paris, for a method of taking the gloss off cloths and other stuffs—5 years.

Jean Pierre Palissard, Escornebœuf, for a machine called a *Tractariaterre*, for transporting earth—5 years.

Bruno de Villeneuve and Jean Jacques Mathieu, silk manufacturers, Lyons, for a method of making watered ribands, called *a grands effets*—10 years.

Sequin & Co. civil engineers and manufacturers, Annonay, for a steam boiler, on the principle of the warm air circulating in small isolated tubes—10 years.

Edward Dodd, pianoforte-maker, for certain improvements—5 years.

William Newton, London, for metallic blinds and window shutters—5 years.

Jacques Francois Adam, Paris, for a new method of binding books —10 years.

Jean Fayolle and Jean Baptiste Joseph Legros, brace makers, Paris, for a loom with four pedals for manufacturing several garters or braces at once—5 years.

Antoine Jourdon, Paris, for a carriage that cannot be overturned, called *douillette d'aplont*—5 years.

Louis Favre, Marseilles, for the making of soap without fire, by means of pure artificial soda, or his salt of soda, and pure olive oil. —5 years.

Andre Millet, merchant, Paris, for a *portraitive* chimney—5 years.

Gabriel Vandemerghel, brewer, Armentieres, for a method of making white beer, as at Louvain—15 years.

Auguste Moineau, clock maker, Paris, for a movement of indestructible pressure applicable to machinery as well as clocks, called *à la moineau*—15 years.

Jean Baptiste Barnard Maitre Humbert, Jean Baptiste Charlemagne Louis-Bazile, and Adlren Chenot, Chatillon sur Seine, for a process of obtaining iron with economy of fuel, without previously melting the ore or dross—15 years.

Martial Theuvoit, innkeeper, Autun, for a machine for stretching the cords of musical instruments—10 years.

Jean Alphonse Camme, mechanician, Malannay, for improvements in the cogs of pulleys, for sea service—5 years.

Charles Frederic Baer, coach-builder, Strasburg, for a method of turning a carriage round short, by means of the fore wheels moving with hinges—5 years.

Gautier, Nantes, for the preparation of, and method of preserving butter—5 years.

Sebastien Prefaut, turner, Nevers, for a press adapted to every purpose where pressing is required—5 years.

Mury, Paris, for improvements in making clogs—5 years.

Louis Jean Pierre Jomard, Valence, for a method of surveying by means of an instrument called a *tact-Graphique*—5 years.

Michel Grand, spinner, Marseilles, for a machine called a *balancier moteur*—5 years.

The Turf Pit Company at Crony-sur-Ourcq, for improvements in the oven for preparing peat—5 years.

Achille de Barnardière, manufacturer, Paris, for a method of making fine baskets and cane work with strips of whalebone—5 years.

Christophe Francois Martin Dillemann, manufacturer, and Jean Michel Reiuhardt, mechanic, Strasburg, for a horizontal bobbin, with vertical pressure, for spinning cotton—10 years.

Alexis Bruno Gensoul, physician, Bagnols, for a method of warming the pans for spinning the silk cacoons with economy of fuel—10 years.

Pierre Revon, mechanic, Paris, for a steam engine adapted to carriages and vessels of all descriptions—10 years.

Caiman Duverger, architect, Soisy sur Etiolles, for a new syringe, called a *clysoir*—5 years.

Etiemne Lasgorsieux, mechanician, for improvements in the construction of machinery for opening, and preparing, and spinning wool, silk, hemp, flax, &c.—10 years.

Francois, junior, and Bernoit, builders, Troyes, for a lithographic press, with cylinders—5 years.

John Neale and Alexander Cowan, Nancy, for a method of preparing and passing cotton and thread through steam—5 years.

Pênelet, father and son, watchmakers, Paris, for an instrument called *compteur de physique et d'astronomié*—15 years.

Louis Joseph Pelleport, and William Poupier, Jeanne Antoinette Selos, Paris, for a method of rendering stuffs and paper of all colours water-proof—5 years.

John Neale and Alexander Cowan, engineers, Nancy, for a mechanical loom which prepares its own warp—5 years.

Antoine George, silk knit manufacturer, Lyons, for a machine for making bricks—5 years.

Pierre Monuet, the son, brandy distiller, at Grand Gallargues, for an apparatus for distilling wines and the dregs of grapes—10 years.

Pierre Fasanini, merchant, Lyons, for a machine for weaving stuffs of all kinds, and which stops when the woof or warp breaks—10 years.

Jean Baptiste Langlois-Quignolot, purse-maker, Paris, for a new stitch, called *point de tulle* or *point à jour*, in making purses, worked by machinery—5 years.

Saint Maurice Cabany, merchant, Paris, for a machine for making a coating of gold or silver, or any other matter, with variegated colours, adapted as ornamental borders, &c. which may be pasted or glued to bronzes, pasteboard, and cabinet works, &c.—15 years.

Matthias Levi Lauzenberg, Morocco-leather manufacturer, Strasburg, for a method of separating in two the skins of calves and goats—10 years.

Pierre Jacques Debezis, Paris, for an elastic bathing tub, called *baignoires dormeuses*—10 years.

Queries by Correspondents.

Mr Editor,—I would wish, through the medium of your Journal, to be informed of the proper number of wheels, and their diameters, to drive different machines with a 15 inch pulley on, to revolve 165 revolutions per minute, from a water wheel 15 feet in diameter, the periphery of the wheel to run 3.37 feet per second. It will, of course, be necessary to give the diameter of the drum, on the horizontal shaft, that drives the pulley on the machine. I would wish those that will take the trouble to make this calculation, would give the proper pitch of the different wheels, allowing the water wheel to be equal to 12 horse power.

An Inquirer.

A citizen of New Jersey wishes to be informed through the medium of the Franklin Journal,

1st. Upon what principle the draft of air furnaces depends?

2nd. What effect an increased height of the chimney will have on the draft?

3d. If an increased height of the chimney increases the draft, what is the ratio?

4th. What effect an increase or diminution of the superficial area of the chimney will have on the draft?

5th. Will a chimney largest at its top, or vice versa, make the strongest draft?

6th. Is it important, as regards the draft, that the materials of which a chimney be composed, be good conductors of heat, or otherwise?

7th. What is the best mode of binding the chimney of an air furnace, to prevent its cracking?

A correspondent has a water fall, head 8 feet—what construction of water wheel is best adapted to gain the full effect of this fall?

Information is requested on the best mode of erecting a trip hammer, together with the proper fall and velocity for any given weight, say 300 lbs.

A subscriber wishes to know what is the best construction for Barker's mill; and what is the maximum power that can be produced by it.

Suppose A C to be a log of any length, of equal diameter throughout: one man sustains the log at A, two men with a porter, or bar, at B, what must be the relative position of the porter at B, in order that every man shall sustain an equal weight?

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania;

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

APRIL, 1829.

Observations on the connexion of Mechanical Skill, with the highest attainments in Science; being the substance of a lecture introductory to a course of Mechanics; delivered to the Franklin Institute, by the Editor, *January 24th,* 1826.

(Continued from page 159.)

The manufacture of pottery had remained. in England, in a comparatively rude state, until Josias Wedgwood, about 60 years ago, effected in it a complete revolution. The porcelain used by the opulent, was imported from France, to the great disadvantage of the English manufacturer. Wedgwood was the son of a potter in Staffordshire, and from early youth was employed in his father's business. His education was very limited, and his patrimony small; but his mind was vigorous, and he soon manifested its superiority by the improvements which he introduced.

By him was invented the Wedgwood, or queensware, which soon not only excluded the foreign manufacture from the market, but also supplied a large quantity for exportation, and gave a new spur to trade, extending the business far beyond all former example. He made himself acquainted with chemistry, instituted a vast number of experiments, and discovered various materials applicable to his business, forming many new species of earthenware and porcelain, both useful and ornamental. As he acquired wealth, he liberally expended it for the promotion of the arts, particularly in their application to his own business. The figures on his cameos and intaglios, rivalled the productions of ancient Greece. The Portland vase, found in the tomb of the emperor Severus, he imitated with perfect

success; in form, in colour, and in the grace and beauty of the figures with which it was enriched.

By his means, the district which he inhabited, became the centre of a vast population, and a place of great wealth. He lived highly esteemed for his moral and intellectual qualities, the associate of men distinguished for genius and science, and died, universally regretted, in the year 1795.

Sir Richard Arkwright, the youngest of thirteen children, whose parents were in indigent circumstances, was originally a country barber; but although he enjoyed neither the advantages of fortune, or of education, nature had endowed him with a fine mechanical genius, and an untiring ardour in the pursuit of his object; these qualities enabled him to rise above the numerous obstacles resulting from obscurity, from poverty, and from prejudice; procuring for him both rank and title, and enabling him to accumulate a princely fortune. His first recorded mechanical effort, was in the pursuit of the phantom, perpetual motion; a phantom which has misled a great number of men possessing more mechanical genius than scientific information, and has sometimes beguiled those who had some claims to learning. Arkwright was induced to abandon his chimera, and he then turned his attention to the improvement of the machinery for the spinning of cotton. At this period, cotton was scarcely known in Great Britain as an article of commerce, whilst at the present day it is, in a commercial and manufacturing point of view, the most important; employing a large portion of her population in the various processes connected with it, and increasing the national wealth, in an unexampled degree.

An individual, obscure, and apparently powerless, was destined, by his mechanical skill, to produce this mighty revolution; the business which he created, caused towns to be founded, where, otherwise, hamlets could scarcely have existed; and has given to the cultivator of the soil in our own, and many other countries, a most important article of produce, exhausting it but little, remunerating the labourer for his toil, and furnishing to every civilized country, innumerable articles of comfort and convenience. Before dismissing this eminent individual, we will remark, that the essential improvements made by him, remain with little or no alteration at the present day; these are, the ingenious mode of drawing out the cotton by means of rollers, and the beautiful process of delivering it from the cards, in a continued fleece. The mechanical genius of Arkwright, was not his only excellence, for after having carried his inventions into complete effect, he introduced into the manufactories in which he was concerned, a degree of order, cleanliness, and industry, altogether unexampled in any similar establishment.

After speaking of the improvements made by Arkwright, in the manufacturing of cotton, we are led, by a natural association, to the steam engine, as it came out of the hands of that scientific mechanic, Watt. At the time when Arkwright was bringing his machinery to perfection, Watt was a mathematical instrument maker in Glasgow. Having attended the lectures of Dr. Black, who was then professor

of chemistry in that place, he had become acquainted with the doctrine of latent heat, as discovered and taught by that eminent individual. A working model of the atmospheric steam engine, was placed for repair, in the hands of Watt; and he was led to remark the great waste of heat, in the condensation of the steam; a waste, the amount of which could be estimated, only, by one possessed of the scientific knowledge which he had derived from Dr. Black. To obviate this, required that singular skill which he displayed in the improvements which he introduced; promoting economy in fuel, acquiring a vast accession of power, and rendering the motions of the machine so equable and manageable, as to adapt it perfectly to the purposes of the manufacturer; thus giving him a first mover, which he could use wherever a small quantity of water and the requisite fuel could be obtained. The steam engine, therefore, contributed in an eminent degree, to the success of the cotton manufacture, as well as to that of many others.

At some other time we shall have occasion to exhibit to you, various proofs of the eminent skill of this philosophical mechanic, who, whilst he acquired the wealth which he so well deserved, gave to his country and to the world, an instrument more powerful in its operation, and more general in its application, than any previously known. At the Chatwater mine in Cornwall, there is a steam engine erected, of 1010 horse power, and, of course, performing the labour which would require the employment of 3030 horses, supposing a horse to perform 8 hours constant labour, in every twenty-four. By this engine, a mine of 600 fathoms deep is kept dry. In numerous instances, mines which had been abandoned, in consequence of the impossibility, or the expense, of keeping them free from water, are worked with facility and profit; and the engine is applied to a variety of purposes, too numerous to detail. In the structure of the steam engine, in its present improved state, we see the application of the principle of mechanical philosophy in a number of beautiful and ingenious contrivances, which give to its motions the appearance of intellectual impulse; whilst a knowledge of the most recondite principles of chemical philosophy, is displayed in the formation and arrangement of its several parts; exemplifying in a manner the most striking, that "knowledge is power," and proving the correctness of the observation, that this machine is "a present from philosophy to the arts."

At a very early period, attempts were made to apply the steam engine to the purposes of navigation; and a patent was taken out in England as early as the year 1736. Some writers of that country have mentioned this circumstance, as a proof that the invention originated in England; and upon this subject a degree of pertinacious illiberality has been evinced, little becoming a high minded people, who have so much of which they may justly boast, without preferring claims that are false, or equivocal. Who is it that really has a claim to the character of an inventor? Is it the man who *thinks* that a certain thing may be done, yet never attempts to accomplish it? Is it he who points out to others the means by which *he* feels

assured the end may be attained, and allows his efforts there to end? or is it the man, who, confident of success, carries his projects into execution, and finds his labour end in abortion? If these be inventors, what are the benefits which society derives from their waking dreams, or their works, which only serve to demonstrate what they cannot do? Yet when some superior genius appears, when a Fulton applies the powers of a mind richly endowed with science, practically skilled in mechanics, and corrected by patient inquiry and observation, and by using the hand of the master, at once accomplishes his purpose, a host of competitors crowd around him, and numbers are even raised from the dead, to dispute the validity of his title. Such was the case when the first steam boat triumphantly stemmed the tide of the Hudson; demonstrating even in this first attempt, the mighty revolution which this means of conveyance was destined to accomplish. Incalculable are the advantages to commercial intercourse, which have resulted from the use of steam boats; not upon our tide waters only, but also upon those magnificent rivers which traverse our country, whose waters roll towards the ocean with a rapidity which rendered their ascent nearly impossible, a task which is now accomplished in less time than that formerly required to descend with the current. Great, however, as are these immediate benefits, and vast as they are, prospectively considered, they, in conjunction with those internal improvements which have been effected, or are in progress, are likely to give a stability to our happy form of government, by increasing and strengthening the ties by which these states are bound together; a good which in itself transcends every other. Although we may lament that justice is frequently tardy in her progress, and regret that an individual who has done so much for his country and for the world, should have himself enjoyed so little of the fruits of his labours, we may yet assure ourselves that posterity will not allow others to divide with him the fame to which he is so justly entitled, and that it will be acknowledged that the whole glory of success was, in this instance, due to American genius.

We may here notice how extensive is the influence of a single discovery, or improvement, in the promotion of objects with which, at first view, it appears to be not at all, or but remotely connected. It is probable, that when Watt made his first great improvements in the steam engine, his views were confined to the rendering it more efficient and economical in its application to the purposes to which it had been principally applied; namely, to the raising of water from mines, or from other situations where this operation was required; and most assuredly, he had no conception of the various uses to which it was destined, even during the period of his own life. He had, however, the satisfaction of seeing his country enriched by the use of the powerful instrument of which he was the parent, from its adoption in almost every manufactory in which great strength, or force, is required; of viewing it substituted for horses in the conveyance of heavy loads, and of overcoming the obstructions from wind and tide, in the navigation of vessels. We have adverted to the facility which it gave in extending the manufacture of cotton;

and of course it thus created a great demand for the raw material, and gave birth to its extensive culture; a benefit in which the United States have largely participated. It would be foreign to the design of this lecture to trace the progress of this staple of our country; but we notice it for the purpose of exhibiting another triumph of mechanical genius, in overcoming the greatest difficulty encountered by the planter in bringing it into the market, at a price which he could command, and which would reward him for his labour. It was necessary to separate the cotton from the seed, of which it forms the envelope; to accomplish this by hand, or by the other tardy methods which had been attempted, was impossible. The roller gin could not be used with the upland cotton, which is the principal product of the country. When picked by hand, 4 pounds were a full day's work, whilst with a gin of 40 jaws, which may be worked by one horse, 2000 lbs. may be cleared from the seed in a day, and the labour performed, is nearly a thousand fold. The numerous cotton gins which are to be seen in every state south of the Potomac, attest the skill of Whitney of Connecticut. This machine, it is said, was first made when Whitney had not visited the south, and had never seen a cotton field.

At a period when the resources of our country offered but few facilities to the votary of science, and when the powerful stimulus afforded by scientific associates, was enjoyed in a very limited degree, the neighbourhood of Philadelphia produced a Rittenhouse. "We have," says Mr. Jefferson, in his Notes on Virginia, "supposed Rittenhouse second to no astronomer living: that in genius he must be first, because he is self-taught. As an artist, he has exhibited as great proofs of mechanical genius as the world has ever produced. He has not indeed made a world; but by imitation, he has approached nearer its maker, than any other man who has lived, from the creation, to this day." David Rittenhouse was born near Germantown; his father was a tanner, and had intended his son for the same pursuit. At the early age of seven years, he manifested his genius for mechanics, by constructing a small model of a water-mill; and he continued through a series of years, to exhibit the superiority of his mind, by his progress in the mathematics, with which he appeared to become acquainted almost intuitively; he also made, first a wooden, and afterwards a brass clock, employing the little leisure which his agricultural labours allowed, in scientific study, and mechanical pursuits. At school, his advantages were of the most ordinary kind. From his father he received no encouragement in the path to which his genius pointed, until he was 19 years of age, when he was prevailed upon to supply him with money for the purchase of a few tools, to enable him to manufacture clocks; whilst such as his funds did not allow him to buy, were produced by his own labour. He continued for many years to make clocks, all of them remarkable for the superiority of their workmanship; and some, for astronomical purposes, were unrivalled in excellence. He also made mathematical and philosophical instruments of various kinds, and of peculiar accuracy, whilst he ardently studied and mastered,

those sciences with which they were connected in their use; and was as skilful in their application, as he was in their construction. His country duly appreciated him, and whenever great accuracy was required, either in celestial observations, or in settling the frequently contested question of the boundary line between states, his services were sought, and that confidence was accorded to his talents as a philosopher, and his worth as a man, which rarely, if ever, allowed an appeal, when his opinions were fully made known.

During, and subsequent to, the revolutionary war, he was frequently called into public employments; he was a member of the continental congress, in the year 1775; of the convention which formed the first constitution of this state, and was unanimously appointed state treasurer. He was the first director of the United States mint, and for several years president of the philosophical society. Soon after the peace of 1783, he was elected a fellow of the Royal Society of Great Britain, a compliment the more valuable, as during the whole of the contest for independence, he had been a steady patriot.

Our time will not allow us to add to our list, many who have strong and just claims to our attention; but there yet remains one whose name must not be omitted, associated as it is in the hearts of all who are now present, with every thing that is good and great in the human character; one who illustrated by his example, the excellence of his maxims, who illuminated the world by his philosophy, and who powerfully aided, by his patriotic efforts, in rescuing his country from the grasp of the oppressor. Need I pronounce the name? FRANKLIN dwells on every tongue; need I advert to the incidents of his life? they are familiar even to the most juvenile part of my auditory. You need not be told that he was a mechanic, compelled when only ten years of age, to labour for subsistence; that in literature he was his own instructer, overcoming by persevering industry and consummate prudence, the obstacles which impeded his career; and thus manifesting what may be accomplished by a vigorous intellect, steadily employed in the pursuit of knowledge, although unaided by the advantages of early culture, in the school of science. I need not tell you how his fame is recorded in the books of philosophy, and in the annals of his country. I need not mention to you the numerous institutions, for the increase of knowledge, and the purposes of benevolence, of which he was the founder; which are the boast and ornament of our city, and which have been admired and adopted by others. This Institute, intended to diffuse the light of science, among a numerous and most important portion of the community, has appropriately derived its name from one whose example is so powerfully calculated to secure the objects of its formation.

I have attempted to place before you a few instances of the power of mechanical genius, when judiciously applied, to elevate the character of the possessor, in a pre-eminent degree; raising the artisan to distinction and opulence, or enabling the philosopher to pursue, with success, his attempts to enlarge the boundaries of human knowledge. We might have swelled our catalogue, would our time have admitted, or had our purpose required it. France, Germany, Italy,

and other European states, would have afforded many illustrious examples; but we have confined ourselves to England and to our own country, as they offer instances more familiar and more numerous. In countries where the iron grasp of despotism is constantly felt, and the great mass of the people is trampled under the feet of a domineering aristocracy, fortunate indeed must he be, whose efforts enable him to surmount the accumulated obstacles which oppose his rise, and confine him to his caste. Happily, we live under institutions which admit of no degrading distinctions, and in a country where the general feeling is outraged by any attempt to render a useful pursuit odious; where the human mind is free to exert its native energies, and to claim and attain the station due to its genius and its merits. Here science freely proffers her aid to the mechanic, and asks his services in return. How eagerly would most of those great men, whose names I have mentioned to-night, have seized upon opportunities, such as are now presented to the rising mechanics of Philadelphia; how would they have been aided in their progress, and have been relieved from days of toil and nights of vigilance, in attempting to attain a knowledge of the first principles of science. May we not hope, or rather, may we not feel assured, that there are now in this hall, some juvenile Franklins, some future Rittenhouses, some incipient Brindleys, who will hereafter amply pay the debt which they will owe to this institution, and, in a manner the most grateful, reward its founders, by manifesting its utility.

The field of science is not contracted by the exertions which have been made to explore it; but like the actual boundaries of our country, is enlarged by the increase of occupants and of culture; nor is there any ocean to limit our eventual progress. As an individual, I can most truly assure those whose benefit it is intended particularly to promote, that I shall never be found deficient, either in zeal, or industry, in the performance of the duties which devolve upon me; and that I count largely upon the assistance which I shall receive from the intelligent mechanic, whose practical observations, I have no doubt, will frequently stamp a value upon my labours, which they otherwise could not possess.

On the Baltimore Rail-road Carriage, invented by Ross Winans, Esq. *and the manner of adapting it to streets; also on cheap Rail-roads. By* J. L. Sullivan, Civil Engineer.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—The principle of the carriage invented by Mr. Winans, has been already mentioned by you in the January number of the Journal of the Institute, with an intimation of your purpose of giving the whole specification at a future time.

In the same number of the Journal, there is also a description of Mr. Howard's rail-way carriage, with a jointed perch, and with friction wheels on the principle of Mr. Winans' *first modification.* It

is not supposed that Mr. Howard was aware of the previous claim of Mr. Winans, and I have understood from you, sir, that Mr. Howard rested his claim principally upon the jointed perch, as a means of turning upon curved rails. Be this as it may, I deem your notice and Mr. Howard's specification, to be sufficiently descriptive of the first mode, and shall, therefore, limit this explanation to the *second*, with respect to the originality of which there can be no question. And this modification derives a strong claim to notice, from the circumstance of its having been preferred by the board of engineers of the Baltimore rail-road.* Perhaps as this communication will occupy several pages of your useful Journal, it will obviate the necessity of your inserting Mr. Winans' specification, which is of considerable length, especially as copies may be had on application.

I do not encumber your work with a discussion of the subject of the right to the first modification, further than to refer to your volume of the last year, in which is found an able exposition of the patent law, wherein decisions under it are cited, which settle among original inventors, the privilege in favour of him who is earliest in practice.

The reasons of the preference given to the second modification by the Baltimore company, were, its simplicity and freedom from fixtures. Besides it is easily converted to use, temporarily, on streets. This improvement in the carriage, consequently obviates some of the greatest inconveniences of the ordinary rail-road carriage, its not delivering loading at its special destination, the delay at its termination, and the expense of drayage.

With the more pleasure, therefore, I avail myself of an invitation of the committee of the Institute, to enter somewhat at large into the whole subject, under the impression that an account of the useful effect of this invention will be the more acceptable, as it, perhaps, is destined to become the instrument of that celerity and economy, in transportation between the eastern end of the Pennsylvania canal and Philadelphia, on which the expected concentration of commerce here, so much depends.

The public works of our country have received their impulse, and public opinion is daily attaching to them an increased value. The form first given to them, had direct relation to the more immediate and most important object, the domestic trade of the states to which they belong. But there is also another valuable object, not always sufficiently distinguished, profit from transport. The agriculture of our extensive vallies, and the minerals abounding in their mountainous borders, demanded canals; and favourable ground, with abundance of water, recommended them. But revenue from *transit commerce*, originating beyond the borders of the state—most active when the western waters are favourable to conveyance far into the country—the elevation of the intervening ground, and our climate, seem to prescribe rail-road communications.

The reasons which induced the intelligent citizens of Baltimore not to rest contented with the Potomac and Ohio *canal*, but to under-

* It is also adopted on the Liverpool and Manchester rail-road.

take a rail-road of unexampled extent and boldness of design, in order that merchandise from that city might reach the Ohio seasonably, are obvious; and if general considerations were sufficient to justify that resolution *before* the compound carriage was known, how much more confidence may be now entertained, since by this invention the Alleghany mountains will be traversed with as much useful effect as the plains of England have heretofore been; and steam power add unexampled expedition to unprecedented economy.

While, therefore, the products of Virginia and Maryland from along the tributaries of the Potomac, must give ample occupation to that canal, as those of New York do to Erie, and as Pennsylvania must to those formed by this state, it will be found that more must be done; that the system of communications will be incomplete, until Philadelphia draws her supplies of merchandise from New York by the facility of a rail-road; and the interior of the state shall reach the wheat market in winter by a continued rail-road, the whole distance from Carlisle. It is alone by economy of access to market, that the flour of Philadelphia can be afforded as low as will be that of Baltimore. And New Jersey will make her canal, but will not neglect a valuable source of revenue more sure from a rail-road for winter travel.

The opinion appears to be established, that our country requires a different kind of rail-road from that employed in England. The comparative density of population, the immensity of her trade, and the moderate extent of her territory, are all contrasted with our widely extended states and sparse population; but, while the greatness of our agricultural produce supplies the deficiency in the comparison as to quantity, there remains with us the present disadvantage of great distances, the uncommon length of our public works of this kind. Less expensive modes of construction, in order that the investment may not be a loss of value in first hands, seems indispensable.

Various forms of rail-way have been suggested; and some of them sacrifice durability too much to cheapness. I aim, therefore, to show how there may be savings enough in capital to allow, besides ample dividends, a reservation from revenue to form a renovating fund. If this fund is allowed to accumulate, at compound interest, rail-roads of a kind suitable to our climate, may be among the best property; because not liable to be rivalled, like turnpikes, by free roads. Railways cost too much ever to be free, besides that they must have an appropriate carriage, owned by the proprietors of the road, that the public may have full accommodation. The public has the same interest with the owners in there being an ample number of wagons.

Perhaps it will be found that a road of the following description, will combine economy with long duration—it will not be elegant, but substantial.

No rail-road can be of long service that is not substantially and accurately made. We may use cheap materials, but the foundations and workmanship must be perfect. In England, they employ much broken stone, for reasons not so applicable to our plan as to theirs.

It serves to keep their blocks in place, and to fill the trenches on which they rest. But great care is taken to form under drains, and take other precautions to preserve the earth dry, and consequently hard. We should here have to go to more expense for the same object, if done effectually. They have to guard against the effects of one foot of frost, but here we have two or three. *Ice* must not be allowed to form among the foundation. It must, therefore, be kept dry. When our plans and estimates propose an imitation of the English rail-way, why is it that the cost is less, notwithstanding iron and labour are here at double the expense? The ground work is not deemed necessary to be so guarded with precautions. Again, in this there is *danger* of *saving too much.*

Timber is so plenty in some parts of our country, that nothing seems easier than to have a rail-road by laying down cross sleepers, surmounting them with string pieces, and these with iron. But how long will it be before the decay of the surface in contact with the ground, disturbs its level and parallel, and the travel tears it to pieces? Posts set in the earth will be more substantial, and may be guarded at the surface, in the following manner.

It is well known that all posts rot only at, and a little below, the surface of the ground; *where heat and moisture combine.* It has occurred to me, that these two causes of decay may be counteracted by surrounding that part of the post by a *pavement set in water lime, or in Roman cement*, (described in my specification thereof.)

Another mode proposed to save expense, is recommended for the Boston and Providence route. It is that of long stone set edgewise on broken stone, to receive a plate rail. Besides the difficulty of fastening iron to stone, when to be acted on, this plan places the rails too near the surface, and subjects them to be covered with ice. The foundation must be rammed equally solid throughout, or the passing of 4 ton loads will depress the string stone where least sustained. It has more liabilities to derangement, than posts, and cannot afford much saving, if the requisite drainage is properly done.

Perhaps the cheapest plan, consistent with firmness, is the following. Let the object be, to make *as much* of the road permanent as can be done with ordinary expense. Let embankments be made at once solid, by puddling. Where wood is used for posts or piles, let them be protected with the cemented pavement, be set in puddle filled with stones, and their heads protected, or, instead of broken stone and blocks, set rough stone posts three feet in width, one foot out of the ground, their heads hewn smooth and drilled for a treenail, with which to secure the bearing timber at *once together and down.*

If the bearing timbers are of *chesnut*, they will be very durable, if split or sawed from the heart to the circumference, because quarters or eighths of the tree will shrink equally, and not crack. Being lodged on the heads of stone posts, they will not decay where in contact; the scarps, horizontal, should have their surfaces separated by a cement of lime and pitch, a composition used by shipwrights.

The form of the timber allows the heart angle, placed uppermost, to be taken off, and a surface formed of 3 inches in width, for the

reception of the rail. A tree of 2 feet diameter, will afford 8 pieces 9 inches deep, with 9 inches base, and these dimensions, if the posts are even 10 feet apart, will be sufficient to bear loads of 4 tons, and be of sufficient lateral stiffness.

The upper surface of the bearer is liable to be heated by the iron while exposed to the sun, and to shrink and crack. To prevent this, the plate may be put on with screw bolts, reaching through, with washers and nuts below; but to give the rail a firm bearing, and allow the cement of lime placed under the plate to remain, two rows of inch nails, an inch apart every way, may be easily driven evenly with the surface of the wood; and then, if the upper surface of the plate is convex, the wheels will run along the middle, and the pressure be equal. The passing load will not have a tendency to loosen the rail; as when flat. A flat rail cannot be mathematically a true plane.

The modes of crossing roads, rivers, &c. are not essentially changed by this plan.

The carriage requires a rather minute description, to be understood by those to whom it is now, for the first time, presented.

If a rail-way is formed firm, smooth, and level, the resistance to be overcome is only friction at the axles, and gravitation when ascending. The latter being a uniform force, when resisting the ascent of carriages, its ratio according to the height of the plane, is alike applicable to the old and the new wagon. Friction must ever exist, however mitigated by the polish of *surfaces* and the use of oil, in proportion to the weight pressing them together. The experiments of Vince proved it to be a uniformly retarding force; those of Colomb, that velocity increasing in geometrical progression, only increased it in arithmetical progression. And we have, you will know, the experiments of Emerson, to prove the proportion of power to weight, when metals of different kinds move on each other. It seems agreed that iron or brass requires one-fifth.

But when the surfaces in question are those of an axle and the nave of its wheel, the friction is under circumstances to be overcome by the augmented power of the lever, that of the 2nd class, which of course common wheels are well known to be.

The mechanical ingenuity of England, appears to have been directed to the perfection of the rail-road and engines; the carriage had received no further improvement than good workmanship. This had achieved the important advantage of reducing the power, according to general practice, to the $\frac{1}{175}$ the load.

In this stage of the art, Mr. Winans conceived the purpose of combining in one carriage, the 1st, as well as the 2nd class of the lever. The effects of friction rollers and friction wheels in machinery, were, no doubt, familiar to his, as to other minds; but to make a *convenient carriage* by this combination, principally for rail-roads, then beginning to be thought of in our country, was worthy of any mind familiar with mechanical science and practised in ingenuity. It was not till after some time had elapsed, that in 1826 he presented his first model at the patent office, with the inquiry, whether this

combination in a carriage were known there. Learning it was not, he deposited it as evidence of his right, and subsequently made that form of compound carriage, described as follows:—

The wheels of common carriages operate as levers of the 2nd class, because the wheel turns on the axle, but when the axle turns with the wheels, it operates as of the 1st class, or as a windlass.

The main travelling wheels of his carriage, are of the latter kind. The fixed axles pass through the wheels, and extend about nine inches from them; the last three inches thereof being converted into smooth gudgeons. These enter under the upper part of the rims of the *secondary wheels*, (those of the 2nd class of the lever,) which, in this modification, are placed outside the large wheels, but do not touch the ground, and are about half their diameter. They have short axles each, which apply in brasses under the double side pieces of the frame, between which they are lodged. Their rims hanging on the gudgeons, their short axles bear up the load frame, and when the primary wheels roll forward on the rail-road, their axles turn, and the gudgeons roll in, on, and under the smooth surface of the rim of these outside wheels, which of course revolve slowly, and turn perhaps once, while the large wheels and axle turn ten times; the bearing or rubbing axles moving thus very slowly, perhaps no attainable speed of the carriage would cause them to heat.

This form of the carriage thus requires no fixtures; but the essential parts are combined naturally together, and work without any liability to separate. Nor is there any friction but that of the small axles, which it is the object of the leverage to overcome. The friction, nevertheless, must be there, however slow they move. Comparative slowness is *incident* to leverage. The space described by the passing surfaces, may be a good *index* of the power employed in this case; but the experiments of Walker and others, have shown that the ratio of resistance is as the weight, nearly, and not as the velocity. Indeed, it is evident that the motion of one end and the other of a lever, is relative. The gain of power is neither augmented nor diminished, by the quickness of the application.

Thus the compound leverage of this carriage conquers the resistance of friction, and allows of augmenting the quantity of load. The horse carries the instrument of his power as a part of his burden. His speed, like that of a steam engine, would accelerate till the force and the resistance balance each other, or steadiness is attained.

You will excuse this to you needless amplification—to some of your readers it may afford clearer perceptions of the mode of operation than before; for this machine, though so simple when understood, at first seems complicate to those not familiar with mechanism.

There are sundry incidental advantages, besides, in this form of the carriage. In passing along curves, the outer wheels will turn as much on their axles as the outer line is longer than the inner line of the track, instead of slipping thus much. They will yield to this resistance, but ordinarily the weight of the load alone fixes the axle in the naves, because they meet with more resistance there than at the gudgeons.

In turning curves of the road, the manner in which the gudgeons are lodged, capable of a little retrocession, allows the flanch which touches the rail, to turn off from it. The flanches are, therefore, on the outside the wheel, and even in great velocity, it cannot gain upon the rail, because it must be turned off with force equal to that with which it acts.

To enable this rail-way carriage to go temporarily on streets, I make the secondary wheels of greater diameter, so that they may reach below the primary wheels and below the level of the rail. When the carriage arrives at the end of the road, *the pavement being there raised to its level, nearly, the secondary wheels take the ground and bear the load.* The main wheels being thus relieved, their axles fall a few inches into scores in blocks, placed on the side frames to receive them. They are thus suspended from use, but remaining in place, when the carriage returns to the rail-road and enters thereon, they rise from their repose, and take the bearing of the new load.

But to enable the carriage conveniently to traverse streets, and be guided, I make the frame in two divisions, and connect them with the bottom of the load body frame by pivot bolts, &c. and apply a tongue which shifts to either end. But these frames, at re-entering on the way, are secured in place.

Another mode mentioned in my specification of the improvement, of converting this carriage to street use, is, to adapt to it a pair of trucks, on which a lever or screw is placed, whereby to lift the fore part of the wagon, and let the hinder part run on the hind secondary wheels.

In the same manner a carriage may enter upon the deck of a ferry boat, and cross to an opposite rail-way, or to a city, as from Amboy to New York.

The superior *useful effect* of the compound carriage of Mr. Winans, may be shown by a very plain mode of calculation.

If we take $\frac{1}{175}$ the ratio of power to load, as the measure of friction of the English carriage, and the horse power at 112 lb. it is 12 lb. $\frac{8}{10}$ a ton. But the compound leverage carriage carrying 500 lb. with half a pound, thus *two pounds* a ton is the measure of *its* friction. But as this ratio was ascertained with only 14 inch and 7 inch wheels, the probability is, that larger wheels would perform better, on a firm and good rail-way.

If, then, we divide 112 lb. the power of a horse, by 12 $\frac{8}{10}$, it gives $8\frac{3}{4}$ tons the load of an English carriage on a level; but if we divide 112 lb. by 2 lb., it gives 56 tons the horse load, with the American, or compound carriage, on a level.

Gravitation operates equally against both, but on ascents the difference lessens, because the force down the plane, is in greater ratio to the friction of the new, than the old carriage; but still the difference will be an important saving again; for example; the force of gravity down the plane being as the height of the plane to its length, we may call 1 foot in a mile, the quotient of 5280 feet divided into 1

ton, which gives $\frac{424}{1000}$ of 1 pound for *one* ton, for *one foot* rise in *one* mile.

If the line is ascending, like the route from Philadelphia to Columbia, $27\frac{1}{2}$ feet to a mile, the gravitating force down it per ton, is $11\frac{66}{100}$ lb., which added to friction $12\frac{8}{10}$ lb. for the English carriage, is 24.46 lb. which divided into 112 lb. is 4 tons $\frac{57}{100}$, of which $3\frac{1}{2}$ tons may be loading. But if we add 2 lb. to 11.66, and divide into 112 lb. it gives $8\frac{1}{5}$ tons, of which 6 tons will be loading.

Thus, although our new carriage doubles the effect of power on this ascent, it is evidently much less than would have been its advantage had it been practicable to find a nearly level route.

Had a line from Harrisburg to Philadelphia been practicable with a slope of $2\frac{1}{2}$ feet to a mile, one horse would have drawn 120 tons, of which 90 might have been loading, and he would have drawn up 36 tons, of which 27 would be loading. But it is justly expected that steam power will give ample usefulness to this route as it is.

Locomotive engines are considered in England now as saving 30 per cent. of the expense. They will be less expensive here with anthracite coal. There is already an improvement in boilers for using it.

Over and above economy in labour, it is of great consequence on long routes, to enjoy speed. It appears by the letters of the engineers of the Baltimore road, now in England, that in one place a locomotive engine of 10 horse power, on an inclination of 10 feet in a mile, runs at the rate of 15 miles an hour, drawing 12 loaded wagons, each loaded with 53 cwt. of coal, the whole 48 tons, and returns up at the rate of 10 miles an hour equally loaded.

If we suppose the compound carriages of Mr. Winans to be used with *such an engine*, their diminished resistance, or leverage, would enable its power to draw up that plane 160 tons, instead of 48. And if the ascent were $27\frac{1}{2}$ feet in a mile, as on the Pennsylvania route, it would have drawn about 40 tons. It appears, too, that in some instances, they ascend 50, in some 72 feet in a mile, with considerable loads, or empty wagons that have been drawn down loaded.

To be able to transport from Philadelphia to Columbia in twelve hours, will be a facility that must assure the transit commerce to the canal. To cross the Alleghany with equal speed, will not be unimportant.

Another advantage from this carriage, when to be used with steam power, is, in rendering the rail-road itself less costly. The engines used in England, weigh generally 8 tons. Of course, the rail-road must be strong enough for loads of 8 tons; though the loads are but 4 tons. That weight of engine has not been considered a disadvantage, though it required double the quantity of iron in the road, because the adhesion between wheels and rails enabled it to draw the desired loads or trains without slipping. But we lessen the resistance of the loads so much, that a 4 ton engine will be sufficient, and the whole rail-road may be for 4 ton loads. This will, if the rails are wholly iron, according to Tredgold's tables, make a difference of one-

half that material item. On a route of great length, this saving will be no small amount of capital.

The evident superiority of effect, when the route is thrown into levels with stationary power, suggests a remark:—That where the intention is to use horses, as may generally be the case on our roads for some time, level roads will be the most useful. Stationary engines, to connect them, should not be considered disadvantageous, but favourable modes of operation. The apprehension that they may get out of order and interrupt the route, is allayed by the recollection that the power may always be divided between two engines *co-operating together*, but capable of working *separately*.

But there are other convenient modes of effecting the passage. You will recollect that Col. Long has converted the locomotive engine to a stationary one, for its own train. And that Mr. Robinson, civil engineer, in the service of Pennsylvania, has taken a patent for his neat invention of a moving water carriage, which being attached, descends, giving preponderance over an ascending train, and the water being discharged, it ascends empty with the next train, while another descends.

In conclusion, it may become an interesting question, how the transportation on a *state's rail-road* is to be managed, so as to produce the utmost economy and the fullest accommodation. The rates of toll must surely be sufficient to the revenues required. The expense of conveyance must be equal to the payment of the tolls, the expenses, and reasonable profits. While the privilege of an improvement in carriages which affords most economy, continues vested for a term, in private hands, the owners, perhaps, forming a corporate company, may carry on the whole transportation, and a state would consult its interest in encouraging this, provided they put on carriages and engines in sufficient number. What then would be the result? At the expiration of that term, the system would be established by experience. And the state might thereafter, by its agents, carry on the whole transportation, and derive a revenue from the profits of the carrying as well as tolls, and thus secure the great public objects of accommodation and revenue.

Should it be acceptable, I will for your next, or a succeeding number of the Journal, give a description of the anthracite boiler for travelling engines, with drawings.

Respectfully, yours, &c.
JOHN L. SULLIVAN.

EXPLANATION OF THE PLATES.

Fig. 1. W. Rail-road wheels.
S, W. Secondary wheels (in section.)
e, *e*, *e*, *e*. Ends of side pieces of frame.
a. Main axle.
b, *b*. Blocks on which main axle rests when suspended.
i, *i*. Iron rails.

c, c. Chesnut tree bearers.
P, P. Posts.
s. Protecting pavement with water cement.

Fig. 2. R. Rail-way.
C. Carriage in profile, showing the *under frames* to give obliquity to the axles when travelling streets.
p. Pavement.

Fig. 3. W. Main wheels.
S, W. Secondary wheels.
P. Pavement on to which the secondary wheel takes when the carriage leaves the rail-road.
I. The eye-bolt to receive the pin of the lever auxiliary wheels which bear the fore part, while the hind part is borne by the hind secondary wheels when on streets or roads.

A novel and interesting case, explanatory of the law of Master and Apprentice; reported for the Journal of the Franklin Institute.

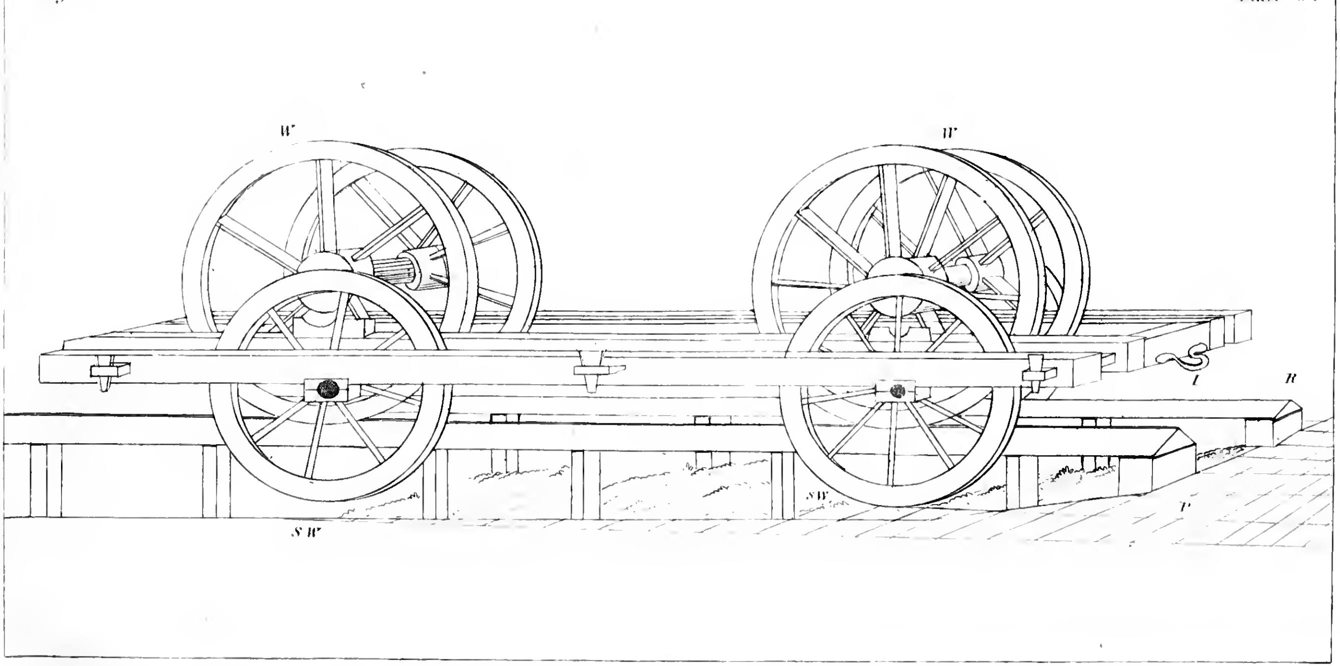
The commonwealth of Pennsylvania, at the relation of Henry Taylor, an infant, who sued by Gasway Oram, his guardian, *vs.* Gurdon Leeds.

Habeas corpus ad subjiciendum, awarded by the Hon. J. Huston, returnable before himself and the rest of the judges of the Supreme Court of Pennsylvania. Gurdon Leeds returned, that he held the relator by virtue of a certain indenture of apprenticeship, by which it appeared that the said Henry Taylor, aged 15 years on the 4th day of July, 1825, *with the consent of his sister, Margaret Leeds,* [who was the wife of Gurdon Leeds,] acting as his next friend, [his parents being dead,] had put himself apprentice to the said Gurdon, to learn the trade of a cabinet maker: to serve 5 years 6 months and 24 days; during which time the master was to find him in boarding, lodging, and washing, and give him *one quarter night schooling,* and when free, one new suit of clothes.

P. A. Browne, who volunteered his services for the relator on account of his being an orphan and poor, contended that he was entitled to his discharge. At common law, said Mr. Browne, the deed of an infant was absolutely void. Even an indenture of apprenticeship, entered into for his instruction and benefit, was not binding. 2nd Inst. 379. 3 Leon. 637, Mod. 15.; but the act of assembly of the 29th of September, 1770, declares, that "all and every person and persons that shall be bound by indenture to serve as an apprentice in any art, mystery, occupation, or labour, with the *assent* of his or her parent, guardian, or *next friend,* or with the assent of the overseers of the poor and approbation of any two justices, although such persons, or any of them, were or shall be within the age of 21 years at the time of making their several indentures, shall be bound to serve," &c., and the first question then was,

Fig. 3.

Plate 5.



WINANS' AND SULLIVAN'S

Pl. VI. RAIL ROAD AND STREET CARRIAGE Journ! Frank!n Inst!

Scale 2 feet to an inch

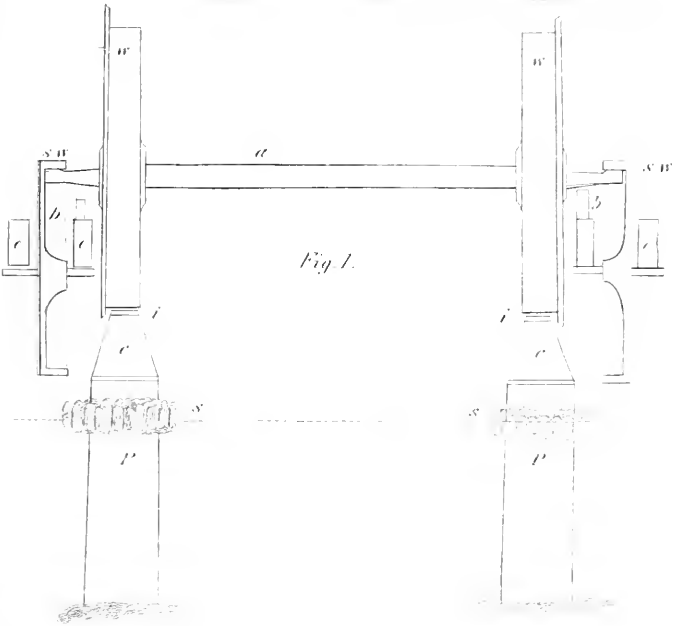
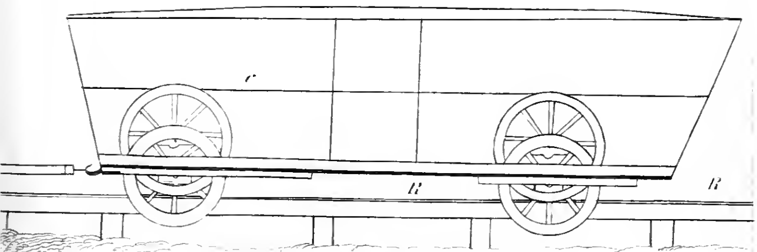


Fig. 1.

Fig. 2



Scale 5 feet to an inch

whether it had been competent for the sister, *being the wife of the master*, to *assent* as *next friend* of the infant. He did not object to her on account of her relationship of *sister;* on the contrary, he admitted that where the parents were deceased, a sister might act as next friend. Nor, upon this view of the case, did he found his objection to the assent merely upon the ground of her being a married woman, for, according to the case of Commonwealth *v.* Eglee, 6 Sergt. and Rawle, 350, a *feme covert* may, in some cases, act in that capacity; but he contended that Mrs. Leeds could not, as next friend to her brother, assent to a binding *to her husband.* It furnished, he said, one of those glaring cases of conflicting interests, where the policy of the law obeyed the precept of religion, "lead us not into temptation." The obvious duty of a next friend in binding an apprentice, is, to procure the best terms for the infant; but how could the wife be expected to execute the office with fidelity, under the powerful attractions of not only her *duty* to her husband, but of her own interest. And he considered it not unworthy of observation, that in this indenture, binding Henry Taylor to serve for a very long period, he was to receive only *one quarter's night schooling.*

As a further proof that the situations were incompatible, he urged that the duty of a next friend was to watch over the master, and even over the mistress, [for much of the apprentice's comfort or suffering depends upon the female part of the family,] and see that they performed their covenants to the apprentice during his servitude. But, said Mr. Browne, how can this lady be called upon to watch over her husband? How can she be called upon to watch over herself? Mr. Browne contended that this indenture was void, not only upon principle, but upon authority. In the case of Commonwealth *v.* Kending, 1 Sergeant and Rawle, 366, an attempt was made to support an indenture upon the assent of one of these nominal next friends, but the court rejected it. There, Cyrus Pearce, who held the infant under an indenture, acted as next friend in binding her by a second one to J. H. Baker; and C. J. Tilghman, in delivering the opinion of the court, observed, that "he thought it would be of dangerous consequence to admit, that a man who was about to sell his apprentice, should take the place of *next friend*, because he must be supposed to be acting *for his own interest*, which is incompatible with the idea of guardian." So here, Mrs. Leeds was acting for her *own interest* in making unfavourable terms for the infant; for the interest of her husband was, by the laws of God and man, identified with her own.

He would also remark, that the chief justice considered the acting of next friend tantamount to taking upon herself the *guardianship*, and according to Osborne's case, Plowden 293, when a woman, guardian, marries, the husband partakes in the prerogative, so that the assent here given was, in law, that of Gardon Leeds to a binding to himself, which was clearly illegal and void.

Secondly, this indenture not only purported to be made with the assent of his sister as next friend, but she had entered into a covenant for the faithful performance of the infant's covenants. It cor-

responds, in substance, with the instrument recited in the case of Meade *v.* Billings, decided in 10th Johnson, 99, where the guardian was held to be liable upon the covenant. But how can a married woman enter into a covenant? Especially if that covenant is to her husband? In Commonwealth *v.* Eglee, there were no covenants on behalf of the *feme covert*, but only an assent to the binding. In this case, she acted in *company* with her husband, and the presumption of law is, that she acted under his coercion. A felonious taking of goods under such circumstances, would not subject her to an indictment for larceny. A transfer of her estate under such circumstances, would be void.

F. W. Hubbell argued on behalf of the defendant,

1st. That Mrs. Leeds answered the description in the act of assembly, viz. "next friend;" the father and mother being dead, and the apprentice having no brother who had attained twenty-one, the duties of guardianship and maternity devolved on the eldest sister, and she was emphatically the "next friend." The act mentions no such exception as coverture.

2nd. That according to the strict technical rule of law, the disability of coverture extends to acts in favour of third persons, as well as to those in favour of the husband; in the latter, they are void upon the same *principle* as in the former; they only differ in *degree;* and that, therefore, when it was decided in Commonwealth *v.* Eglee, 6 S. and R. 340, that a *feme covert* may give her assent as next friend, under this act of assembly, the present case was ruled in principle.

In the same case, Commonwealth *v.* Eglee, the nature of this *assent* is thus defined: "it is a personal confidence reposed in her by act of assembly; she parts with no property, divests herself of no interest." A power or confidence reposed in a married woman unaccompanied with any *interest*, may be well exercised by her in favour of her husband, although the exercise of it require discretion, as a power of sale, &c. Coke Lit. 112, and 4th Cruise, 181. Tysee *v.* Williams, 3 Bibb's Rep. 368.

3d. The cases of purchases by executors, trustees, &c. at their own sales, have no analogy to the present case, although we should admit such an identity between husband and wife, as to render the exercise of a power in favour of her husband, in effect an exercise in favour of herself; for at law, such a purchase by an executor or trustee, when made in the name of a third person, is good. Equity interferes on grounds of policy. Such a case as *this* has never been agitated in courts of equity, and *technical* rules of equity, which preclude inquiry into the *real* equity, are not to be extended beyond their letter. Equity avoids such a sale, by putting the purchaser in *statu quo*, returning him the purchase money with interest, &c. Sugden's Venders, 433, and a tender of this is essential to the *cestui a que trust's* claim of relief. But here no offer is made of compensation to the master, for the instruction and sustenance of the apprentice, during the time he has been with the master—as yet he has

been only onerous; his services, after he acquired the trade, were to be the requital.

4th. That heretofore it has only been contended, that the fact that the next friend in the indenture was the wife of the master, does not *per se* vitiate the indenture. If there were *actually* an undue influence, it is otherwise. Nay, we are willing to admit that the law regards such a transaction with jealousy. If this indenture be subjected to scrutiny, even with such a disposition, it must be sustained; for there is no extraneous proof of undue influence, and on the face of the indenture we find all the usual covenants. It has been objected that the schooling covenanted for, is not sufficient; but it may be answered, that the boy was considerably beyond the usual age of binding, and so advanced in education, (as appears from his signature to the indenture,) that he did not need that more schooling should be stipulated for.

Lastly, that the act of assembly does not require the next friend to enter into any covenants, but merely to give *assent*. Therefore, the covenants by the next friend in this indenture, were merely surplusage, and could not vitiate it, *utile per inutile non vetiatur*. That the covenants by the next friend being entirely in favour of the master, it was he alone who could object it, if they were void.

Per Curiam Gibson, chief justice.

There must undoubtedly be an actual, and not merely a formal next friend. His office, however, is not to bind the apprentice, but to allow the apprentice to bind himself. The covenants of the apprentice, although executed under the supervision of those whom the law has set over him, are exclusively his own. Such are the provisions of the act of assembly, and such was the construction of it in the Commonwealth *v.* Eglee. The practice has, for the most part, been for the *prochein amy* to express his assent by sealing the indenture, but no one ever thought of having recourse to him on the contract, at least no instance of the sort has fallen under my notice. The reason is, that the legislature has not said that he shall become a party. The assent is sometimes expressed by subscribing as a witness, but neither in the one case nor the other has the *prochein amy* considered that he was binding himself for the apprentice. His covenant, if any existed, would be joint. But that would be inconsistent with his power, which is not to subject, by any act of his, the person of the apprentice to the dominion of the master; that can be done only by the apprentice himself. The *prochein amy* can join in the act only so far as the law gives him authority; and by the terms of the act of assembly, his agency is not to be active, but passive. The point was expressly ruled in the Commonwealth *v.* Eglee, where the coverture of the *prochein amy* would have afforded a decisive objection, if she had been considered a party to the deed. That case establishes also, that the subjection of a *feme covert prochein amy* to her husband's will, is not, in contemplation of law, inconsistent with the free exercise of her will in the execution of her trust; and this, in analogy even to the common law, which permits a wife to act in a representative capacity, and independent of her husband, wher-

ever the subject matter is unconnected with his interest or marital rights. The pinch of the case here, is, that the binding was to the husband. But in equity, and even in some instances at the common law, wherever a *feme covert* has power to act as if she were sole, she may treat directly with the husband. As, however, the matter depends on construction, it is urged that expediency requires that the act of assembly be so interpreted as to avoid the tendency to abuse of power, which must necessarily exist in every case like the present. That would be a grave consideration, were abuses of the sort not subject to redress. But an effectual corrective may be found in the supervising powers of the judges, who are bound to discharge wherever the contract is shown to be tainted with actual fraud or collusion, and in a case like the present, the transaction would be more strictly scanned than if the binding were to a stranger. We will not, however, discharge, of course, where, as in this case, the covenants appear to be reasonable and proper on the face of the indenture, especially where the application is not made till the apprentice has ceased to be a burthen. It is objected that the quantum of schooling is unreasonably small. It appears, however, from the apprentice's signature to the indenture, that he wrote a fair hand; and the great object of the binding being to learn the art and mystery of the master, I would hold an indenture valid, without any covenant for schooling at all, if it should appear that the education of the apprentice had been sufficiently attended to before. It, therefore, appears to a majority of the court, that no reason had yet been shown why the apprentice should not be remanded.

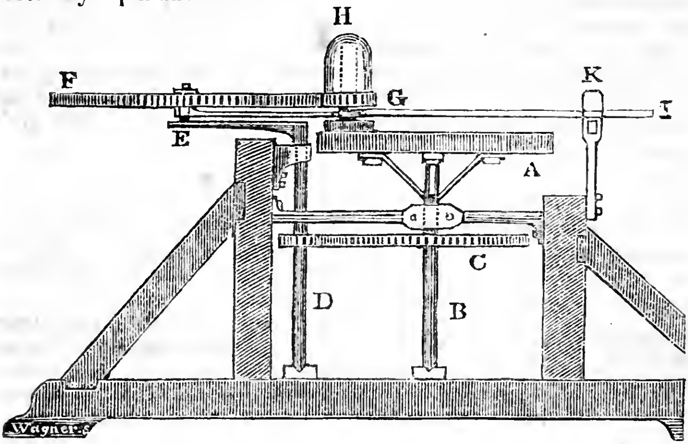
Tod, justice, dissented.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Description of a Machine for Grinding Painters' Colours, Printing Ink, &c. Invented by W. J. Stone, *Engraver, Washington, D. C.*

Various machines have been invented for the purpose of grinding colours, which, however, are applicable only in the large way. In my own business I have felt the want of one which would answer well as a substitute for the ordinary stone and mullar, and have constructed an apparatus for this purpose, which I have found to fulfil my expectations. The annexed drawing will serve to explain its structure. The principal frame is made of wood, properly braced together, and need not be described. A, is a round table, or slab of cast-iron, turned, and ground flat on its upper surface. This is supported by a shaft B, running upon a pivot below, and supported by a collar above, so that it may turn freely. To the cog wheel C, fixed upon this shaft, motion is given in any suitable way, as by another cog wheel geared into it, and turned by a crank, or a whorl upon the shaft, acted upon by a drum and strap. This cog wheel takes into a pinion, on the second shaft D, which has an arm E,

projecting from, and standing at a right angle with it. A cog wheel F, is firmly fixed by its centre, to a pin rising from the arm E. This cog wheel turns a pinion G, on the mullar H, which mullar is in two parts, the upper part, H, which serves as a weight, which may be increased or decreased at pleasure, and drops upon a square pin projecting from the lower, or grinding part. This pin is round, where it passes through the arm I, to admit the wheel F, to turn the pinion G, and consequently the mullar. The arm I, turns freely upon the pin projecting from E, and slides freely through a hole in the swivel K, the upper and lower part of which are connected by a pin and socket.

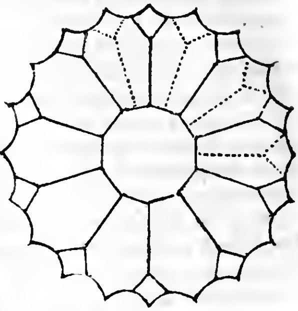


It is unnecessary to describe the action of the machine, as this must be evident from its construction. It will also be seen that the length of the arm E, must be proportioned to the diameter of the table A, that it may carry the mullar to the right distance from its edge, on either side. W. J. S

On the form and arrangement of Bricks used by the ancients in the construction of Fluted Columns.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—In a late visit to the city of New York, my attention was attracted to the church now being built in Canal street. Its front appeared to be a copy of that of the temple of Theseus at Athens. The ingenious arrangement of the bricks to produce the fluting of the columns, recalled to my memory the following contrivance used by the ancients to produce the same effect, and which I send you, with a hope that it may afford a useful hint to some of our architects.



In examining, several years ago, the ruins of Pompeii, I noticed several doric columns broken off a few feet from the ground, and this circumstance gave me an opportunity of observing their internal structure. I found they were composed of bricks of two different forms and sizes, as in the annexed diagram. The full lines show the form of the bricks, and the dotted lines show the joints of the course next below, and the manner in which these joints were broken so as to form a good bond.

The gradual diminution of the column was effected by making the lateral joints between the bricks larger at bottom. The central part was filled by a circular brick. W. H.

On improvements in Marbling the edges of Books and Paper.

[Translated from the *Dictionnaire Technologique,* for the Technological Repository.]

This art is confined to a few persons only, who take great pains to preserve it secret, and will not make any communications thereon, but under considerable remuneration. One of the most skilful workmen in Paris, to whom I had rendered some essential services, was, however, willing in return, to initiate me in his mysteries, and execute his processes before me; and he likewise furnished me with the necessary details, to enable me to describe them; not, however, without my engaging to conceal his name, lest it might draw upon him the animadversions of his fellow-workmen. The following is the process:—

The utensils employed by the marbler are not very numerous:—First, a vat, formed of oaken planks, well fitted together, so as to be perfectly water-tight. Secondly, a small cylindrical staff. Thirdly, several earthen vessels, to contain the colours and other preparations. Fourthly, a small portable stove, or furnace. And fifthly, a grinding stone, of porphyry or marble, and a mullar, to grind the colours; these are indispensable requisites.

On the preparation of the gum.—Put into a proper vessel, half a pail full of water, or about eight or nine quarts, and dissolve in the cold, about three ounces and three-quarters of gum tragacanth, stirring it frequently for six days: this is termed the *couch*, or *bed;* and upon this bed are to be spread the colours which serve to form the marbling; they do not, however, mingle with each other. This quantity of gum is sufficient for marbling the edges of four hundred volumes.

A solution of gum, much stronger than the above, must likewise be provided, in order to increase the thickness of the bed, when

necessary; of which proof is to be made in the manner to be hereafter described.

Preparation of the ox-gall.—Put the gall into a dish, and add to it an equal weight of water, and beat the whole up well together; then add to it ten drams of camphor, which has previously been dissolved in one ounce of alcohol, and again beat up the whole thoroughly, and pass it through a filtering paper. This preparation should not be made earlier than the day before it is to be used, lest it should spoil by keeping.

Preparation of the wax.—Over a slow fire, and in a glazed earthen vessel, melt yellow virgin wax; when it is melted, it is withdrawn from over the fire; and then mix with it, by degrees, and stirring it continually, a sufficient quantity of essence of turpentine, to give it the consistence of honey. Ascertain when it has attained the proper degree of fluidity, by putting a drop of the mixture upon the nail, from time to time, and let it cool; and add more of the turpentine if it is too thick.

Like the ox-gall, the wax must not be prepared too long before using it.

Of the colours.—We do not employ the heavy mineral colours in marbling; animal and vegetable colours, and the ochres, are the only ones which can be employed with success. The other mineral colours are too heavy, and could not be supported upon the surface of the gummed water.

For yellow, we employ Naples yellow, or the yellow lake from weld. The golden yellow is made with *terra de Sienna*, in its unburnt state.

For blues, of different shades of strength, use the best indigo, known by the name of "the flower of indigo."

For red, either employ carmine, or carmine lake.

For brown, umber.

For black, ivory black.

The white is produced by the gall itself.

Green is produced by the mixture of blue and yellow.

Violet, by yellow and red.

And aurora, as in ordinary paintings.

The *terra de Sienna*, the flower of indigo, and the carmine lake, are employed separately, in the manner we shall describe, and make very fine and sharp figures, which may be varied to infinity.

On the preparation of the colours.—These are to be ground very fine, and made into mixtures, of the consistence of a thick soup, or *bouillie*, either upon the slab of porphyry, or one of marble, with the prepared wax and water, together with a few drops of alcohol. When they are well ground together, take up a small quantity of the colour with a palet-knife, which is inclined, to let the colour fall upon the surface of the gummed water, to prove its consistency. When each colour is ground and mixed up, it must be put into a pot, and kept apart from the others.

On the preparation of the marbling vat.—From the vessel which holds the prepared gum, take a sufficient quantity of it to cover the

bottom of the marbling vat, to the depth of an inch at least. Then add seven ounces of alum, in fine powder, and beat it well up, to dissolve the alum. Put a spoonful or two of this prepared water into a conical confectionary pot, in order to make the necessary trials with it, to ascertain whether the gummed water be of the proper consistence for use, as follows:—

Take a little of the colour which has been ground of a sufficient consistence with the prepared ox-gall, and throw a drop of it upon the gummed water in the conical pot, and stir it in a circular manner with the small rod. If it extend well, and form a spiral figure, without dissolving in the gum, it is sufficiently strong; if, on the contrary, the colour will not turn, the gummed water is too thick, and water must be added to it, and be well mixed with it, by beating it up; but if the colour spread too much, and dissolve in the gummed water, then some of the stronger prepared gum water must be added to it, which was kept in reserve for this purpose. At every time of adding either water or gum, the whole must be well beaten up to make the mixture perfect. After every trial, the conical vessel must be emptied, and its contents thrown aside, and a fresh portion of the gummed water employed. When the gummed water has thus been brought to the desired consistence, it must be passed through a sieve into the marbling vat, to the height of an inch, as we have before said.

The marbling vat being thus prepared, and all the colours ground and thickened with the prepared wax, and ox-gall, so that they be not either of too thick, nor of too thin, a consistence, first take the gall, and spread more or less of it upon the gummed water. The colour first thrown on is to be less thick than the succeeding one, and that again thicker than the first, and so on. We first throw on the red for instance. All the other colours intended to be used are then thrown on, one after the other; that which is laid on second, presses the first on all sides; and as the number of the colours is the more considerable, so the first is spread, and occupies a larger space. When all the colours which we would employ are thrown on, if we desire that the marbling should take the form of a volute or spiral, we hold the rod upright, and then carry it along amongst the colours in a spiral manner. The colours are thrown on with a kind of pencil made by the marblers, thus:—They take for the handles the twigs of osier, about a foot long, and two lines in thickness; they also employ about a hundred hog's bristles for each pencil, and of the greatest length possible; they arrange these bristles all around the smaller end of the twig, and tie them strongly with packthread. These pencils, with their long bristles, more resemble brooms than pencils. With the assistance of these pencils, they throw on, here and there, all over the gummed water, the first colour; then, in the middle of that, the second; then the third, &c.; so that when they are spread, these sets of colours approach one another; they then stir them in a spiral or other shape, as they judge necessary. We shall give an example:—

Suppose we would give the marbling the form known by that of

"*the partridge's eye.*" We prepare two tints of blue with the flower of indigo; the one, such as we have before-mentioned, and which we designate by the name indigo, No. 1; the other, in a different vessel, and to which we add a larger proportion of the prepared gall, and term indigo, No. 2, we first throw on the carmine lake; secondly, the *terra de Sienna;* thirdly, the indigo, No. 1; and fourthly, the indigo, No. 2, to which has been added, before throwing it on, two drops of essence of turpentine.

The blue, No. 2, last laid on, extends all the other colours, and affords a clear blue in spots, which produces a fine effect. It is to the essence of turpentine that this effect is owing; we should therefore add a little of it to all the colours which are to be thrown on last; it would be useless to mix it with the preceding ones.

When all is thus disposed, the marbler takes eight or ten volumes, and commences by marbling their front edges, which he first prepares by laying the back of each volume upon a table; he then turns back the boards, and applies a clamp, which he affixes by screwing its jaws close, and thus levels the front edges. He does the same with all the other volumes; he then takes each up between both his hands, and plunges it into the vat. Thus the front edges are marbled.

He then takes the same volumes, loosens the clamps, and strikes upon their ends to make them all enter the gummed water at the same level; he then again clamps them and treats them in a similar manner.

The marbler can vary his patterns *ad infinitum;* they depend upon his taste both in the arrangement he gives to every colour which he employs, and in the number of the colours used.

Paper is marbled in the same manner, and with the same colours, prepared and thrown upon the gummed water in the vat, as the edges of books. But instead of using a round staff, we use combs, with teeth more or less apart, to form the volutes, or any other figure we please, and which may be varied to infinity.

All the address consists in adroitly placing the sheet of paper flat upon the surface of the gummed water which supports the colours, and to withdraw it again without deranging them. In order to do this, the workman takes between the thumb and fore-finger of one hand, the sheet, in the middle of one of its ends; and with the other hand, and between the thumb and fore-finger also, the middle of the other end of the sheet. He then lays the sheet upon the gummed water, and again removes it, without suffering it to slide upon the coloured surface. He then hangs the sheet upon the bar of a frame, with the coloured side outwards, to evaporate the water, and to dry it.

This sheet being thus finished, he marbles a second, and so on; but he always adds fresh colours after every one is dipped.

When the sheets are dry, they are waxed, glazed, and folded for sale.

On Morocco Leather Dressing.

[Translated from the *Dictionnaire Technologique,* for the Technological Repository.]

The true Morocco leather is made of goat skins, tanned and dyed on their outsides. Sheepskins are treated in a similar manner. It seems that this leather is termed *Morocco* leather, from the art of dressing it being originally brought from that country.

This manufacture was established in France, towards the middle of the eighteenth century. The first accounts of the manufacture of Morocco leather in the Levant, were given by Granger, a surgeon in the royal navy, and an excellent observer; who made voyages to different countries, by order of the minister, the Count de Maurepas; and successively transmitted to the Academy the most valuable discoveries in divers branches of the manufactures, as well as in natural history. His description of the art of dressing Morocco leather, which, with other processes, he saw executed in the Levant, is dated in the year 1735, and the details of it were published by Lalande, in the Encyclopedia. Since this period, many establishments for dressing Morocco leather have been formed in France, and especially that of M. Fauler, at Choisy-le-Roi, which is become the most important and celebrated, for the superiority of its products.

It would be useless for us to describe the details of this manufacture in its commencement; and which followed the processes described by Granger, and published by Lalande. They have also lately been much simplified in their manipulations, and improved in others which were hurtful; so that the manufacture has received some real improvements. We shall now proceed to describe several of these ameliorations.

The skins which are employed in this manufacture, are, as we have above said, those of goats and sheep. The first of these are not only more pliant, but their surfaces are smoother, and they are likewise more durable than those of sheep, but their employment is restricted, on account of their high price.

The manufacturers in Paris procure their goat skins from various places; in France, those from Auvergne, Poitou and Dauphiny are preferred. They also procure quantities from foreign parts, and especially from Switzerland, Savoy, and Spain; the last, in particular, are much sought for, on account of their strength and other good qualities; so also those of France are esteemed for their thinness. The manufacturer has it thus in his power to make his choice in regard to these qualities, and also to lay aside those skins which appear defective, or are unfit to receive the finer dyes, especially the reds. It is nevertheless impossible, with all his care, to perceive in this selection the slight cuts made in the skins by the knife of the flayer; or the small lumps left in them, from the punctures of insects, but which are, however, sufficient to render the skins greatly defective, when they are to be dyed red, which is a colour the most delicate, and requires the highest perfection in the skins: and thus the

manufacturer is frequently obliged, in the progress of the manufacture, to submit his skins to new inspections, and to class them for dying; that is to say, to reserve the defective ones for the darker tints, and employ the finer ones for the brighter colours, and especially for the reds.

The goat skins are received in packs, in a dry state, and therefore the first process they are subjected to is intended to soften them, and to open their pores, in order to enable the substances employed in the succeeding operations to penetrate them. This object is readily obtained by immersing them in stagnant water for a longer or shorter time, according to their degree of dryness, their thickness, and the temperature of the season. In this first steeping they undergo a kind of fermentation, which cannot be carried too far, without danger of their beginning to putrefy, and consequently necessarily altering their quality. It is practice only which can guide them, as to the length of time required in steeping them; and which may be from two to five days. When they think that the skins are sufficiently softened, they avail themselves of this state to give them their first dressing upon the horse, in order to separate any morsels of fat or flesh which the butchers may have left upon them, and which were not visible in the folds which were formed in them during their drying. After this preparation, they are again steeped in fresh and cold water for twelve hours, and are lastly rinsed in similar water.

When the skins have been well drained, they are put into square pits, filled with lime, mixed more or less with water. These pits are generally constructed of stone or wood, and are about four or five feet long, and as many deep. The intent of this new immersion is to dilate the reticular tissue, and thus to loosen the roots of the hair, and permit it to be removed easily. In this, as well as the preceding operation, certain changes occur, which habit only can indicate. Thus, it is by no means a point of indifference to leave the skins for a longer or shorter time in the lime; it is also necessary to graduate its action, and to follow a series of continued observations, in order to seize the precise moment when the proper effect has been produced; as, otherwise, the lime, by too prolonged action, may exercise an injurious influence, and the skins will become swelled and spongy. We thus see, that we must carefully guard against the corrosive action of the lime, according to the greater or less fineness of the skins, and the temperature of the atmosphere; as it is certain that its action is greatly accelerated, when the heat of the air is increased.

In order to proceed with more certainty, the steeping of the skins in lime-water is usually commenced in those pits where, from length of time, the lime has become partly carbonated, by remaining in contact with the air, and its action has become less energetic, and then to finish with those pits in which fresh lime has been put. It is also necessary in this process to observe a due period throughout; and that its progress be neither too quick nor too slow. If the pit be too strong, it will be seen that the skins are powerfully attacked by

the lime, after a day or two's immersion, and it becomes necessary therefore to remove them into a weaker one. If, on the contrary, we find at the end of twelve or fifteen days, that the hair is not loosened, then we must have recourse to a pit capable of acting upon them with more power. We must also take care, during each immersion, not only to lift the skins from time to time, in order to permit the lime to renew itself, and to penetrate both sides of the skins, but we must also take them out of the pit, and replace them again, at least once in every two days' time.

When they have been steeped for the proper time, they are taken out of the pits to be scraped, in the following manner:—Each skin is stretched over the horse, and with the aid of a blunt round knife, similar to that used by the tanners, the hair is removed; in order to do this, it is sufficient to pass the knife backwards and forwards over the entire surface of the skin, at the same time exerting a slight degree of pressure. This operation being finished, they proceed to the succeeding one, which consists in completely freeing the skin from the particles of lime contained in it; this is highly essential to the final success of the process, which the lime would entirely frustrate, by giving to the dyes a great number of shades, which, from their multiplicity, would be exceedingly expensive to remove. This process has, however, lately been greatly simplified, without lessening the final perfection of the work. They commence by laying the skins to cleanse themselves in a river for one or two days. They then proceed to clear the skins from any small portions of flesh which may still adhere to them. This operation requires great care, and considerable practice, to detach them cleanly, and without injuring the skins. At this time also they shave and equalize the thickness of the skins.

They next dress the hair sides of the skins with the *querce*, which is a long flat plate of stone, of a fine and hard quality, being a species of hard schistus, and which is enclosed half its width in a piece of wood, of which the ends project eight or ten inches on each side, and are rounded, to serve as handles; this species of blade, or stone knife, has its edge rounded; with this instrument they expel, by the slight pressure they exert in using it, the last remains of the lime which adhered to the skins, and at the same time soften the hair sides of them. Then, after having well drained the skins, they repeat the process of rubbing upon the flesh sides of them, and compressing them strongly upon the horse, with the round blunt-edged knife; they are now ready to undergo the preserving process.

Formerly, between each operation, and they were very numerous, they pressed and beat the skins in wooden vats, by means of wooden rammers or pestles. But now they are content to beat the skins about for a quarter of an hour each time, in a barrel, mounted horizontally upon two necks or pivots, and the inside of which barrel is furnished with a great number of wooden pins rounded at their ends. They introduce the skins into this vessel, and a quantity of water proportioned to their number; and, after closing it, they turn it rapidly round by means of a handle or winch affixed upon the axis

of a toothed wheel, which acts in a pinion affixed upon the axis of the barrel.

We have before spoken of the inconveniences which the lime occasions when its action has been too long continued; and we may now add, that it was no doubt in order partly to remedy these that many manufacturers diminished the quantity of the lime, and supplied its want by employing a proper proportion either of wood-ashes or of common pot-ash; and which probably produced the same advantages without being attended with those inconveniences. We are besides strengthened in this idea, by the knowledge, that other persons have recommended the employment of stale urine for similar purpose, and which we regard as infinitely preferable for this kind of work, probably on account of the ammonia which it develops. It seems to result, from this reasoning, that those alkalies which are the least caustic, merit the preference, whilst they still possess their cleansing properties, and they are easily removed by slight washings; whereas the lime is much less soluble, and, in the state of division in which it is employed, it introduces itself within the pores of the skin, where it remains; and combining with the organic matter, communicates new properties to it. It is certain, that let them take all the pains possible to remove the last remains of the lime, not only do the skins preserve their rigidity, but the presence of this alkaline earth acts as a kind of mordant upon the dying materials employed, and modifies them so as to produce many various tints totally different from that which was designed to be given to the leather.

We see, after what has been above stated, how very important it is that the lime should be entirely extracted; and it is this, doubtless, that rendered necessary the preliminary operations before dying the skins; nor can we otherwise conceive the utility of that which is termed *le confit*, an operation with which we are now occupied.

In the description of this process, published by Lalande, we find a third bath mentioned, to which he gives the name of *le confit;* this is nothing else than dog's dung, mixed with water to the consistence of thin soup, and in the proportion of from twenty-five to thirty pounds for eight dozen of skins. The author pretends that this *confit* removes their rawness, and disposes them to soften or swell during their fermentation; and, which is more, that this dung cleanses the skins by the action of the alkaline parts which it contains, and facilitates the removal of the grease which they retained, and which hindered them from taking the desired colours. Now we are ignorant upon what facts these various assertions are founded; and we must say, that it is scarcely likely that the skins should retain any appreciable quantity of grease after the cleansing processes they have been subjected to, and where the lime and the potash employed must necessarily have produced the effect of converting it into a soap more or less soluble. We may then suppose that the real utility of this bath is to bring on that species of acid fermentation which precedes putrefaction. What leads us to this belief, is, that we know most of the manufacturers of Morocco leather have entirely discon-

tinued the use of this dung-bath, and only use a sour bath made with bran, which can only produce a certain proportion of acid; and if this be the case, *this* confit, we apprehend, must operate upon the skin, principally in consequence of the acid thus generated removing that portion of the lime which the skin may have retained. We also believe that it is this acid which produces the swelling spoken of by Lalande, and which he believes tends to prepare them the better for tanning.

However this may be, when the skins have undergone the different processes, and have been well washed, they are last immersed in a bath of sour bran, where they are left for a day and a night; they are then hung upon the horse to dress or clear them, and those which are intended to be dyed red, that is to say, the finest skins, are immediately salted, in order to preserve them until they are to be dyed.

We may observe, on this last point, that the salt most probably performs another office, and that it not only preserves the skins, but it is a fact, that whenever salt comes in contact with soft animal substances, it first swells them up; but it afterwards causes a great part of the water which they had absorbed, to flow out; and then makes them shrink. This effect is particularly remarkable in the intestines of animals which are salted in order to preserve them; and we do not see why the same effect should not happen with respect to their skins, the cellular tissue of which is contracted by the salt; and as the salting precedes the dying, it may be presumed that it also favours the latter process, by rendering the surface of the skin more compact and smooth. Another advantage likewise results, which is, that the skin becomes less porous and more difficultly penetrated by the dye, and which consequently can be used with more profit. From a similar motive, each skin is folded double, and stitched along its edges, with its hair side outwards, in order that the dye may not be applied to the flesh side.

[TO BE CONTINUED.]

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS GRANTED IN JANUARY, 1829.

With Remarks and Exemplifications, by the Editor.

1. For a manner of *Preparing White Lead for Painting,* without grinding; John Barney, New Haven township, Huron county, Ohio, January 2.

This is a process for rendering white lead miscible with oil, without the trouble of grinding. The means prescribed are simple; the paint, according to the declaration of the patentee, dries with a finer surface than that from ground lead; whether it will stand equally well, requires the test of time. Being a recipe, we do not publish it without permission.

2. For *Drying Cut Tobacco,* in tobacco factories; George Campbell, Schenectady, New York, January 7.

The patentee states that it has, heretofore, been the practice of tobacconists to dry their cut tobacco upon tables of the ordinary construction, which, in large establishments, demands a great deal of room, the want of which produces much delay. The improvement for which the patent is obtained, is the use of a number of tables placed one above the other, allowing an interval of five inches between each. They may be variously constructed, so as either to be moveable or stationary, with or without framed corner posts, &c.

In the plan represented in the drawing, all the tables are made to let, or lower down, so as to lie flat upon the lower table; the upper one is then covered with tobacco, and raised into its place, and the whole, in succession, charged in the same way.

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3. For a *Washing Machine,* called the "Complete Washer;" Reuben Mosher, Galway, Saratoga county, New York, Jan. 8.

Should this washing machine excel its predecessors in utility, as greatly as the length of the specification transcends that of the larger number of them, it will justify its name, and be a *complete washer.* We have repeatedly noticed the great number of patents issued for washing machines, and are really of opinion that this number actually exceeds that of all the individual washing machines in use in the Union, with the exception of the simple fluted board.

There is in the present machine, a display of a considerable degree of ingenuity, and, perhaps, too much complexity; we can only give its leading features; those who wish the details, may apply to the patentee, who will be glad to sell them a machine.

There is an oblong box, or trough, a fluted cylinder, standing across this box, with gudgeons and a crank to turn it. Below the cylinder, and within the trough, there is a moveable bottom, called a shoe, which is made concave in the middle, to correspond with the convexity of the roller. Across this shoe, there are small rollers, thirteen in number, between which and the large roller, the clothes are to pass. This false bottom is borne up by spiral springs, which act upon it through the medium of sliding rods, on the outside of the trough. There are contrivances for increasing or decreasing the pressure, according to the nature of the articles to be washed.

It is at first proposed to make the large roller of one solid piece of timber; but a second method named, is, by spiking plank on to circular ends, the pieces being fluted, as in the former. The points claimed are,

First. The construction of the great cylinder, as last described.

Second. The mode of tightening or relaxing the springs.

Third. The mode of raising or lowering the large cylinder.

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4. For a *Thrashing Machine;* James S. Wood, Pattonsburg, Botetort county, Virginia, January 9.

(See the specification.)

5. For a "Variator" for taking the *Measure for Cutting Clothes;* Levi Peterson Lemont, Bath, Lincoln county, Maine, January 9.

The machine called the *Variator*, is an upright post, rising from a stool, or block, to the height of about six feet; from this project arms, which are made to slide up and down in long mortises, or slots; with a number of wooden pins, swivels, gauges, graduated tapes, scales, &c. &c.; twenty-one particular parts being enumerated. Against the variator, the person to be measured is to stand, when the various moveable parts of the machine are to be so placed as to designate certain heights, lengths, and widths, whilst circumferences, and segments of curves, are ascertained by the graduated tapes. We are altogether unlearned in the art and mystery to which this machinery is to be applied, and therefore beg leave to be excused from saying any thing of the merits of an article which we have not the talent to analyze.

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6. For *Combs* to be made of wood, ivory, horn, &c.; Samuel Lambert, Hanover county, Virginia, January 9.

"This invention consists, in fact, of two combs, the one generally finer than the other; they are usually about two inches and a half long, and one and a half wide." They are made "so that two of them shall protect each other, by the passing of the ends of the teeth of each one, into a groove in the back of the other." "When the combs are so locked, or shut together, the ends form the segments of a circle; the backs are so finished that they appear round, or cylindrical, and the combs are finished so smoothly and neatly, as to be used with great convenience as pocket combs."

We are told that combs similar to the above have been, for a considerable length of time, on sale, manufactured and brought into market, by different persons; they certainly did not appear to us under the form of new acquaintances. For the interest of the patentee, however, we hope there is enough of novelty in them to sustain his claim, as they are sold sufficiently cheap to meet the wants of the public.

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7. For a plough denominated the *Prairie Bogging and Ditching Plough;* John Gordon, Capec, Columbia county, New York. Assigned to Jona. J. Coddrington, New York, Jan. 13.

This plough, as its name indicates, is to be applied in bogs, or meadow ground, only. The standard of iron is attached to the beam in the usual way, and screwed on the inner face of the *land side*, as in the common plough. The *land side* is of cast-iron, about 6 inches deep, 1 thick, and 3 feet long from heel to toe, with a pin or blade on the bottom edge of the *land side*, about two inches wide at the heel, and narrowing to a point nearly opposite the standard. This blade is to make a horizontal cut, at the bottom of the bog; there is

fastened to it, by screws, a sharpened steel blade, or cutter, of such size and form as to make a horizontal cut in shaving the bog from the soil, of about two feet. In front of this there is, attached to the beam, a vertical steel cutter, of about eighteen inches in length, six in width, and one in thickness at the back; this is brought to a perfectly sharp edge; it is curved back, so as to cut with the greater facility. The mould board is not formed to turn the sod, or bog, over, but to slide it out of the furrow, to be afterwards removed. A draft bar passes through a mortise in the beam, standing at right angles with it, and being about two feet in length. This is to afford to the team a parallel draft on the land side of the beam. "Thus, in the manner of using, the team travels on the unploughed land, by means of the draft bar, the horizontal cutter enters lightly upon the surface, cutting the bogs, roots, stumps, &c.; the vertical cutter separating the cleft turf from the land, whilst the mould board forces it from its bed, leaving the ground surface level, and completely cleared for tillage."

"What I particularly claim as my exclusive right, is, the application of the *draft bar*, to the said plough; and its general application in cutting bogs, and ditching in prairies, and bog meadows."

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8. For a machine for the *Cleaning of Paper Rags*, by which great expense and labour are saved; William Debit, East Hartford, Connecticut, January 13.

(See specification.)

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9. For an improvement upon mills, being a mode of *Supplying Water to Water Wheels;* John Haughton, Greensborough, Green county, Georgia, January 13.

The plan or plans of Mr. Haughton are such, in part at least, as have been frequently proposed, sometimes essayed, and always found to disappoint the hopes of the projector. One part of his plan may answer very well in certain situations, where there is a stream with a strong current, and the banks unsuitable or inconvenient for the erection of a mill. It is proposed in this case, to erect a water wheel to be driven directly by the current, for the purpose of pumping up water to be conducted in pipes, or troughs, to such a place as may be preferred for a mill, and there to use it to drive an overshot wheel.

Another plan is to use horses, or other animals, upon an inclined wheel, to pump up water from a pond, stream, or well, to such a height as to drive a water wheel by its fall.

Although the horses or oxen employed in this way would not perform more than one half the effective labour which might be derived from a direct application of their weight and muscular strength, there would still be some power left, and the patentee may, therefore, console himself in some degree, by referring to the plans which have been devised and patented, to cause a wheel to pump up water enough to drive itself, and propel weighty machinery.

10. For improvements in the *Manufacture of Salt;* J. A. Teissier, Boston, Mass. January 13.

This patent has been recently surrendered, and a new specification filed, in consequence of some defects in the former. The new patent will come under regular notice at the proper time.

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11. For an improved *Press,* formed by a new and powerful combination of cranks, or wheels, and levers; Thomas Bakewell and John P. Bakewell, Pittsburgh, Alleghany county, Pennsylvania, January 14.

The principle upon which this press operates, is that which is usually known by the name of the *toggle joint.* The patentees state that it consists of "three principal moving parts, by which the effect is produced, and the combination of which we claim as our invention."

"These three parts we denominate, *first,* the lever, or crank, by which the power is applied. *Secondly,* the pitman or connecting rod, by which the power is transmitted to the *third* part, or sliding piece, or head, by which the effect produced by the other parts of the press is communicated to any substance exposed to its action."

To us it appears very similar to several of the modern printing presses, to many seal presses, working with the toggle joint, and various other machines, in which the power of the lever, as it vanishes, becomes infinite; that is, when a right line extending from one of the extreme points of action to the other, would pass through the fulcra. It is said in the specification, "a different combination of the above described principle may be applied, in case it shall be found more convenient, by substituting for the above described first part, or lever, a crank, or cranks, which are to be connected with the sliding head, by means of one pitman rod, or more, and joints as above described, care being taken to regulate the said pitman rod, or rods, so that it, or they, shall form with the crank, or radius thereof, if the crank be curved, a right line between the axis of the crank, and the base of the press, at the time the greatest pressure is required."

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12. For an improvement in the *Mill for Grinding Apples;* David D. Demarest, New Milford, Orange county, New York, January 14.

(See specification.)

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13. For a *Washing Machine;* Amos Larcom, Watervleit, Albany county, New York, Jan. 16th.

This machine bears considerable resemblance in its action to that described, No. 3. There is an oblong trough and a drum, but the drum, instead of being fluted, is covered with rounds, so as to appear reeded. Within the trough and under the drum, small rollers cross, forming a concave, within which the drum revolves, and between

which and the drum, the clothes pass. The gudgeons of the drum pass through sliding pieces, confined by vertical boxes on the outside of the trough, the slides being forced down by spiral, or other springs, to regulate the pressure of the drum upon the clothes.

The patentee says, "what I claim as new in the above machine, is, the construction of the drum, the periphery of which is formed of rounds, or slats; and the use of springs to adapt it to the quantity of clothes passing between it and the rollers.

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14. For a wheel for *Spinning Wool and Cotton* by hand; called the "Ohio Spinner;" Nathaniel Harris, St. Clairsville, Fairfield county, Ohio, January 21.

This is a contrivance of much simplicity; what novelty and utility it may possess, we shall leave to the determination of others, after furnishing an outline of the structure, and the claims of the patentee.

A piece of plank, four inches wide and three feet long, is fastened against the wall of a room. Towards one end of this is affixed an iron axis, or pin, upon which turns a wheel exactly like that of the common wheel for spinning yarn. A band from this wheel turns a whorl, which revolves upon another iron pin near the opposite end of the plank. If six spindles are to be used, there are to be upon this whorl six grooves, besides that upon which the band of the large wheel passes. Upon a frame above the whorl, there are six spindles with whorls; one band passes round all these, and the grooves of the long whorl, and, of course, its tension is the same on all.

A carriage, or brake, to hold the rolls, is suspended to the frame, but is neither well described or figured. It has a forked wire fastened to it, to serve as a handle by which to work it. There is a single large spindle standing alone, just above the long whorl; its use we do not perceive, excepting it is occasionally to be used alone, when it becomes a common spinning wheel fastened to a wall. What is claimed is as follows:

"1st. The right of constructing the woollen wheel against the wall, or side of the house."

"2nd. The right to construct the single and double geared head together, as above described."

"3d. The right to run spindles on round rails, with leather stretched round to hold the collars, so that the points will run steady."

"4th. The right to run a single band on the short grooved whorl, with any number of spindles above one, so that they may all twist at all times alike."

"5th. The right to make a brake with the jaws at the bottom, with the forked wire guide and hinges."

"6th. The right to apply the head, by means of boards and a whorl, as before described, to the common wheel now in use, thereby giving it greater velocity and ease of application, with much less expense than any machine now in use."

15. For an improvement in the mode of *Hanging Forge Hammers*, for the manufacture of bar iron, called the Clam Boit; Jonathan M'Neal, Colerain, Lancaster county, Pennsylvania, January 21.

The specification states, that "the boit formerly used was of cast-iron, about twelve or fourteen inches long, and four inches square, with one, two, or three, indentations for the pivot of the husk to work in; it was fitted into the leg lengthwise, even with the surface, being immoveable, or nearly so. The improved boit is of cast-iron, from twelve to sixteen inches long, ten to fourteen inches wide, and two inches thick, with clams, or flanches, on the ends, about one and a half inches deep. It is fitted into the leg, even with the surface, the flanches being on each side, sufficient room being left to raise and lower it at pleasure by keys; also room for keys between the flanches and the leg to fasten the boit, and to regulate the hammer so as to strike fair on the anvil."

"In the centre of the boit, there is a square hole, about four inches on the side next the husk, and three on the opposite side, in which a cast or wrought iron nut is inserted, with an indentation for the pivot of the husk to work in. This nut when worn, may be removed, and a new one substituted without renewing the boit."

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16. For a *Conical Steel Grist Mill*, to run vertically, principally for grinding Indian corn into grist or meal; Thomas Baker, Sumter district, near Statesburg, South Carolina, Jan. 21.

There is nothing particularly striking in this mill, by which to distinguish it from others which have been previously constructed and extensively used; the most celebrated of these, is that which was much used in the French army, and is well known to those conversant with the history of mechanical science. The present specification does not designate the points which are claimed, but merely describes the whole machine.

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17. For an improvement upon Levi Jacobs' *Razor Strap*, or strop; J. W. Osborn, Terre Haute, Vigo county, Indiana, January 21.

Agreeably to our rule, we shall not give the recipe contained in this specification, but merely say that it is only another version, in addition to its thousand predecessors, of a mode of using leather, emery, and crocus, with certain ingredients to form the two latter into a paste, and that, like them, it will be good or bad according to the care with which it is prepared.

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18. For a machine for *Hulling or Husking Cotton Seed;* Francis Follet, Petersburg, Virginia, January 21.

The seeds of cotton contain a very large portion of oil, of a quality which adapts it to various useful purposes. In pressing this seed with the husk, or hull, upon it, a considerable portion of this

oil is lost, in consequence of its absorption by the fibres of cotton which remain upon the hull after the ginning process is completed. A facile mode of removing this hull is, therefore, a desideratum. The quantity of cotton seed which is annually wasted, might, if collected, be made to produce many thousand tons of oil; the end proposed to be accomplished is, consequently, one of national importance.

This machine consists of a cylinder formed of stone of a rough grit, or of any other material to which a rough surface may be given by artificial means. This cylinder runs within a concave segment, placed at such distance from it as just to allow the seed to be hulled to pass between them, in doing which it is subjected to a double action from the revolution of the cylinder and a sliding action given to the concave segment. There is a sifter and other appendages, to separate the hull from the kernel. We are informed that the machine fulfils the expectations of the inventor, so far as its action is concerned, and requires only to be fully known to prove its great utility.

The claim is, "the adaptation of the cylinder, and concave part, as to the construction, or form, and face, or working surface, and set, and the mode of feeding, and the mode of sifting and separating the grosser part of the hull or husk of the cotton seed from the kernel."

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19. For a *Compound Lever Press*, adapted to the pressing of cotton, tobacco, paper, and many other purposes; John Rodgers, Maury county, Tennessee, January 21.

This is in fact a rack and pinion press. The follower is a rack, sliding through the cap timbers of the frame, and attached below to the follower block, under which the articles to be pressed are placed. The pinion is on the shaft of a rag wheel; this rag wheel is acted upon by means of a vertical lever, having a click which falls into the notches upon its periphery, with a second pall, or click, to hold it as the feed is given by the first. The vertical lever receives a vibratory motion from a crank on the shaft of a wheel or wallower, driven by any convenient power.

Claim not specified.

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20. For an apparatus to be used for the *Cure of Inflected Spine* in the human body, called the Dormant Balance; James K. Casey, New York. First patented June 23d, 1828. Patent surrendered in consequence of a defective specification, and reissued January 21.

We published the first specification with a wood cut, and have a plate now engraving for the second, which will shortly appear.

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21. For making or manufacturing of *Blanks for Checks*, or drafts, or bills of exchange, or other such like instruments; James Atwater, New Haven, Connecticut, January 21.

We have already noticed this invention in a former number of this Journal, having extracted from Silliman's Journal an article written upon the subject, by that gentleman. The details of the method would occupy much space, and ought not to be given without the approbation of the patentee. The claim of the inventor, is in the following words.

"The said inventor does not claim an exclusive right to make and sell such blank instruments as are now in use, whether of the common form, or containing upon them any ornamental margin, or work, or the name of the drawer, and whether printed from types, or plates, with common, or vegetable, or other inks. But he does claim as his invention, the foregoing improvements upon all such instruments as are now in use, and whether printed from types or plates."

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22. For an improvement in *Spinning*, called a "Cap Spinner," being an improvement on the "Ring Groove Spinner;" John Thorp, Providence, Rhode Island, January 23.

This will be noticed, together with several other improvements in spinning, recently patented by the same gentleman.

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23. For a mode of *Straightening and Soldering Drums or Cylinders*, such as are used in cotton and woollen factories; Luke N. Perry, Worcester, Massachusetts, January 23.

A strong bench is made of such length as may be necessary for the longest drums. This bench is to be perfectly straight; at its back edge a ledge is formed by fastening on a straight solid piece of stuff, rising nearly to the height of the diameter of the drums; a second ledge is prepared, which may be secured upon the bench, at any required distance, so as to form a trough or gutter to contain the separate pieces which are to be soldered to form the drum; a third piece of stuff is hinged to the top edge of the back ledge, so as to rise and fall like the lid of a box. Across the bench, and each of the pieces forming the trough, grooves are cut, to the depth of about half an inch, exactly where the joinings of the sections of the drum take place.

When the cylinders formed by the individual pieces of tin, or other metal, have been made, they are slipped into each other, like the joints of a stove pipe; they are then placed in the angle against the back ledge of the bench; the front ledge is forced up and secured, and the moveable piece, called the press beam, is brought down and secured by proper catches. This press beam laps upon the cylinder, or drum, no further than is necessary to confine and keep it straight, so that a portion of its periphery, say one-fifth, is left uncovered; the joints are then soldered for that distance, when the strips are loosened, the drum turned, and again secured; then all the parts are successively united, when the whole must, necessarily, be perfectly straight. Provision is made, at one end of the table, for securing and soldering pieces, the lengths of which may differ from that ordinarily employed.

24. For a *Churn*, called the "Forcing Valve Piston Churn;" Benjamin Cushwa, Clear Spring, Washington county, Maryland, January 24.

This churn stands like the common churn, and may be made of an oval form. It is divided into two chambers, by a partition, which may reach within a small distance of the bottom. Two dashers are made to fit as closely as possible into these chambers; the piece which forms the partition is allowed to project above the top of the churn, to support a lever of two arms, working on a centre pin, through a mortise in this partition. To this lever, the handles or rods of the dashers are connected, so as, alternately, to work up and down. There is a valve in the centre of each dasher, opening downwards, in order to allow the cream which passes the edges of the dashers, to find its way below them, in their ascent.

In working the lever, the cream is forced backward and forward under the partition, or through holes near the bottom of it. The claims are,

"1st. The communication between the two chambers, or the small holes (or openings) at the lower part of the division."

"2nd. The manner of attaching the lever to, or on, the top part of the division, or middle part of the churn."

"3d. The principle of forcing the cream to and fro, from one chamber to the other, through the small holes (or under) in the division, or middle piece, by the application of the valve piston, together with the manner of making and applying a valve on the piston of the churn."

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25. For a machine for the *Planting of Corn*, called the 'Farmer's Assistant;' Matthew Lennox, William Croft, and Henry Pitner, Steubenville, Jefferson county, Ohio, January 26.

A carriage is framed together; this runs upon two wheels, connected together by a roller of such length as to allow of the planting of two rows of corn at the same time. The circumference of the wheels is equal to twice the distance at which the corn is to be planted. There are two hoppers, over the cylinder within the wheels, to contain the corn, with two cups, holding the number of grains intended to be dropped, there being two droppings in each revolution of the wheel. Two colters open the ground to receive the seed, and two small harrows follow to cover it over.

The specification does not make known the particular points claimed, nor does it give a clear exposition of the exact structure of some important parts; it commits a fault common to a great number of those which are sent to the Patent Office, in giving precise dimensions for parts in which size is of little consequence, and in these minute details obscure the essential features of the things intended to be made known.

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26. For a machine for *Cutting Sausage Meat;* Elias Wade, Elizabethtown, New Jersey, January 26.

A shaft with two cranks is turned by a wheel and pinion. These cranks work two cutters, which rise and fall in guides. A circular tub, or trough, beneath the cutters, contains the meat to be cut; this revolves upon friction rollers, having motion communicated by means of whorls and bands from the crank shaft. There are scrapers borne against the sides of the cutters by springs, serving to clear the meat from their edges.

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27. For a machine for the manufacture of *Shoe Pegs;* Silas Beckwith, Silas Beckwith, jr. and Eleazer Beckwith, Westmoreland, Oneida county, New York, January 27.

A sliding gate works in grooves, on two uprights; at the bottom of the gate is a cutter, or knife, to split the block into strips, there being a contrivance to regulate their thickness. The strips are held in a clamp, and a plane with two irons forms them into long wedges; these are afterwards split into pegs, which, of course, are bevelled on two sides only.

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28. For an improvement in the manufacture of *Forks,* with four or more tines, commonly called spring tempered, or patent forks, or pitchforks, used for manure, bark and other purposes; Calvin Perkins, Waterbury, New Haven county, Connecticut, January 27.

This specification refers to two other patents which have been obtained for similar purposes, upon which it claims to be an improvement. The details of the manipulations in forging the fork, are minute. The principal points, however, appear to be the welding of a piece of iron into the centre of the steel bar from which the fork is to be formed; this piece of iron forms the shank which passes into the handle, and being of iron, does not harden when it is heated and suddenly cooled in fixing it; and the particular mode of slitting and drawing out the steel bar, at each end, according to the number of tines required; as will appear from the claim.

"What I claim as my improvement, is, the fastening, or welding the piece of iron to the bar of steel, for a shank, and the improved method of preparing the bar of steel by means of fastening on the shank, and swedging down the bar of steel on each side of the shank, so that the tines are easily and cheaply drawn out."

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29. For an improvement in constructing *Screw Docks* for raising vessels to be repaired; John C. Ely, New York, January 28.

A dock is prepared, into which the vessel to be raised is to be floated. A frame work of strong timber, supported by posts, is erected in a way particularly described in the specification. Screws of iron, or other suitable material, of 20 feet in length, for a vessel of 500 tons, are passed in two rows through these timbers, and work in metal boxes in the ends of cross timbers, placed under the water. In

the dock described, there are 32 screws, forming two rows, 16 at each side of the dock, acting upon 16 cross timbers, or sections, placed at equal distances from each other. The vessel floats into the dock, above these sections; the screws are then turned so as to make them bear against the keel, and the vessel secured by proper shores, blocks, or bilge wedges.

By means of chains, wheels, and pinions, geared into their heads, or nuts, the screws are turned with greater or less power, according to the resistance to be overcome, and their motion is facilitated by the aid of friction rollers. When the vessel is ready to be raised, men are placed at each screw, that every part may bear the same strain.

To lessen the strain upon the screws, chains are sometimes to be attached to each end of the sections, and made to pass over pulleys above, so that counter weights of from 5 to 15 tons may be suspended to them.

A floor of plank is to be laid from section to section, to make a platform for the workmen.

The claim is for the "method of applying the screws, whereby the sections are suspended upon the screws, and are not forced up by the screws having a firm rest or bearing under the water, upon which they rest. The application of weights to the raising of vessels in a screw dock, as above described, acting in combination with the screws." A particular arrangement for applying it to steam boats, with their guards, and all their machinery. And the "combination of wheels, chains, and gearing, so as to enable a man, by one continued motion in a circle round the wheel on which the lever is placed, to raise up the screw to which the gearing is attached."

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30. For machinery for *Cutting Wafers, and Leather for Gloves, &c. &c.;* Elisha Mills Ely, formerly of New York, but now of Paris, in the kingdom of France, January 28.

The contrivance explained in the specification of this patent is merely the placing of sharp cutters upon a table, or platform, then laying the article to be cut, as sheets for wafers, leather, &c. upon these, and passing a roller or rollers over it, so as to make sufficient pressure; or otherwise, to draw the table or platform under the rollers; the pressure of the rollers being regulated by springs.

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31. For a machine for *Breaking Sugar*, denominated the 'Sugar Break;' Woolsey G. Sterling, Bridgeport, Fairfield county, Connecticut, January 28.

A cylinder about four inches in diameter, has four rows of knives set along it, spirally, at the distance of about half an inch apart; this cylinder is made to revolve, horizontally, by means of a crank. A row of similar knives affixed to a piece of timber, and projecting out about three inches, is placed across a trough on one side of the cylinder, the revolving knives of which pass between those upon the fixed timber. The sugar to be broken is placed upon an inclined

board, and drawn down so as to be acted upon by the knives, between which it falls, and is collected underneath.

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32. For improved *Canal and other Boats*, for propelling, steering, and preventing the rolling of the waters, and the washing away the banks of canals, &c.; Samuel D. Bennet, Butternuts, Otsego county, New York, January 30.

The boat described is to be driven by steam; there are two water wheels, the buckets of which are made in the form of scoops, the more perfectly to take hold of the water. The propelling wheels are fixed within a race, towards the stern of the boat, the sides of which project below the buckets, to still the agitation caused by them. The boat is to be steered by the bow as well as by the stern; for this purpose a wheel, formed like a half globe, with buckets, stands across the bow, and receives a motion in either direction by a long shaft extending along to it from the after part.

We deem it unnecessary to describe it further, as these are the novelties claimed.

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33. For *Cooking Furnaces* and Ovens; Leonidas V. Badger, Dover, Strafford county, New Hampshire, January 30.

The furnace is of cast or wrought iron. The oven is a cover, which may be variously formed, and is to be placed over the furnace, with proper contrivances for containing the articles to be boiled, baked or roasted. The whole structure is explained, but a particular description would require drawings, which we think the subject does not demand.

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34. For a mode of *Spinning Yarn* from sheep's wool, called the 'Canton woollen bobbin and flyer;' William B. Taber, Canton, Norfolk county, Massachusetts, January 30.

The mode of spinning above referred to, is by means of a fixed spindle, with a revolving bobbin, driven by a band, and worked up and down by a lever, or cam, to distribute the yarn. Upon the top of the spindle there is placed a metallic cone, the lower edge of which serves to distribute the yarn upon the bobbin, as it rises and falls within the cone. The twisting of the yarn is effected by the revolution of the bobbin. We shall, probably, hereafter give the whole specification with illustrations.

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35. For elastic *Water proof and air proof cement*, paint, or varnish; John J. Howe, New York, January 31.

We have seen specimens of the articles prepared by Mr. Howe's process, which appeared fully to justify the character indicated by the title of the patent. The process, involving the publication of a recipe, we omit.

36. For an improvement in making or *Manufacturing of Cider,* being a combination of machinery, called the 'Portable horse power cider-mill and presses;' Uri Emmons, New York, January 31.

This is a cider mill and presses, intended to be removed with facility from place to place. In its general appearance it bears some resemblance to the ordinary fire engine. A vertical shaft rising from the centre, is worked by horse power, a sweep being put on for that purpose. There is a hopper in which to put the apples, with fluted rollers below, by which they are ground; a chamber, closed by a spring, to receive and retain stones, or other hard substances, which may, by accident, be mixed with the apples. The presses are formed by the lower box, each end of which is a chamber to receive the pommage; two screws, placed horizontally, are forced forward into these chambers, by gearing from the horizontal shaft; by these the pressure is made, and the cider allowed to run out from the chambers at proper openings.

"Now, what the above named Uri Emmons claims as his improvement, and for which he solicits a patent, is, 1st, the combination and peculiar construction of the several parts, combining one part so as to form another part. 2nd. The principle of the chambers for receiving hard substances. 3d. The horizontal double geared screws for presses, (horizontal or perpendicular.) 4th. The forming and constructing the apparatus so as to be a portable machine, yet possessing the advantages and conveniences required for making cider, so that it can be used any where, without being in, or attached to, a building. The stone chamber and doubled geared screws I claim, whether attached to this or any other cider-mill press."

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37. For an improved *Grist Mill,* or mill for grinding grain of every kind into flour, or meal; or for grinding plaster stone into fine plaster; Benjamin M. Kemp, Fort Plain, Montgomery county, New York, January 31.

The moving stone in this mill may be either a cone or a cylinder, the axis of which is to stand vertically, and may vary in size, according to the power applied, or work to be done. The fixed stone, which is to stand upon a bed of solid timber, may be in a single piece when the runner is conical, as the feed is thin, regulated by raising or lowering the running stone. When this is a cylinder, the outer stone may be in two or more pieces, surrounded with iron bands, through which screws may pass to force up the different sections. The stones are to be furrowed in the usual manner. When the mill is constructed for shelling corn, it may be made in the form described; but the body may be of wood instead of stone, and the furrows made by nailing or screwing on strips of iron.

The claim of the patentee is not specified, although some of the advantages which he thinks this mill offers, are stated by him. Conical mills, patented and unpatented, of stone and iron, have been repeatedly made; the claim intended to be established cannot, therefore,

be to the form, as indeed the including a cylinder in the description would sufficiently indicate; nor can it be to the division of the outer stone into sections, as this appears to be adopted with the cylinder only.

It may fairly be made a question whether two distinct machines are not described in the specification; namely, a mill, of stone, for grinding different materials, and a machine for shelling corn, which machine is made of wood and iron.

SPECIFICATIONS OF AMERICAN PATENTS.

Abstract of the Specification of a patent for a Thrashing Machine. Granted to James S. Wood, *Pattonsburg, Botetourt county, Virginia, January* 9.

The thrashing part of the machine is composed of a cylinder, and a curve, in which the cylinder revolves. The cylinder is 5 feet long and 21 inches in diameter. Strips of hoop iron are nailed lengthwise upon the cylinder, so as to cover its whole surface, the edge of one lapping upon another, and thus forming a series of ridges or furrows all around it. Four rows of projecting iron points are affixed in the cylinder, to serve as feeders, to force the straw between the cylinder and the curve; these stand out about three-quarters of an inch above the surface of the cylinder. The curve is a piece of timber, hollowed out to suit the roller: it is placed in front of it, its hollowed part extending in width about 9 inches, from a little below the centre, to the upper part of the roller, and above it rises a piece of plank to conduct the straw into the hollowed part. The curve is covered with strips of iron, in the same manner as the roller, there being vertical grooves in it to allow the projecting feeders of the cylinder to pass it in their revolution.

The distance between the curve and the cylinder is about $\frac{3}{16}$ of an inch. The cylinder is made to revolve about 220 times in a minute, by any proper means. The wheat, or other grain, to be thrashed, is laid lengthwise of the roller, between it and the guide piece, and is carried down by the feeders. Two persons are employed in feeding, the cylinder being long enough to take in two lengths of the straw. There is no feeding apron, the sheaves being unbound, and laid upon an inclined platform just above, and back of the cylinder, whence it is taken by hand.

The gudgeons of the roller work in sliding timbers, which admits of the space between it and the curve being changed, according to the nature of the grain to be thrashed. The mode of doing this may be varied, and is not claimed, the thrashing part being all that is considered as new. The specification concludes thus:

"The following is intended as a view of the features of this machine, designating it from all other inventions of the same kind."

"This machine differs from all others that thrash by means of a

cylinder and curve, viz. in the first place, in the mode in which it forces the straw through the space between the cylinder and curve, by means of the feeders; thereby rendering it impossible for the straw to clog up in the space, and choke the machine, which is a disadvantage attendant on all other machines working with a cylinder and curve."

"Secondly, it differs in this, that the straw is, by means of the feeders, confined to that part of the surface of the cylinder on which it first falls, and is forced through the space between the cylinder and curve, with the same velocity that the surface of the cylinder moves; whereas, in other machines, working with a cylinder and curve, the straw is not forced through the said space with any thing like the same velocity that the surface of the cylinder runs, but remains awhile in the curve while the cylinder glides, or runs, upon it. The advantage arising from the straw being confined to the surface of the cylinder is considered to be this, that the impulse, or shock, given to heads of the grain on their being dragged through the said space by the feeders (with equal velocity with the cylinder) is much greater than when the cylinder glides or runs upon the straw, and requires little more than half the velocity in the cylinder that is required on the other plan, and a consequent proportional diminution of the power necessary to apply to the machine when thrashing; as is proven in the fact, that one horse of ordinary strength is able in this machine to thrash out 100 bushels of wheat in a day, provided the wheat is sufficiently good to yield a bushel to two dozen, and with this power from seven to eight sheaves can be thrashed in a minute.

A third property of this machine, distinguishing it from others, relates to the mode in which it gets out the grain, viz. the straw being confined by the feeders to the surface of the cylinder, as before stated, the instant it falls on its surface, the head of the grain is severely lashed against the said piece of timber placed on the top of the curve; and whatever may remain in the head is rubbed off, by the furrows in the curve, in its passage through the space between the cylinder and the curve. The curve, therefore, of this machine is more effective in thrashing or rubbing out the grain than the cylinder; whereas, in the other machines alluded to, the cylinder is most effective. as its surface runs on the heads of the grain, and its furrows rub it out while the heads of the grain remain for awhile in the curve.

JAMES S. WOOD.

Specification of a patent for an improvement in the Mill for Grinding Apples. Granted to DAVID D. DEMAREST, *New Milford, Orange county, New York, January* 14, 1829.

A PAIR of stones is put in operation (by water, or any other convenient power,) somewhat similar to those of a grist mill, except that the lower stone is the runner, instead of the upper one, and

the face of the upper stone is concave, and the lower one convex, that they may clear themselves of the pummage the more readily, and thereby facilitate the grinding. The acclivity of the face of the convex stone forms an angle with the horizon, of about thirty degrees; the concavity in the face of the upper stone, is sufficiently greater than the convexity of the lower one, to admit an apple of the largest size between them at the eye, while they operate closely enough at the outer edge, or periphery, of the stone, to grind the apples to the required fineness. The eye of the upper stone, into which the apples feed, is twelve or fifteen inches in diameter; the hopper is placed directly over it, and the apples, by their gravity, are forced into the eye of the stone. By the motion of the lower stone, aided by the dress and the surfaces, each regularly descending from the eye to the periphery, the apples are passed rapidly through between them, and ground in a very superior manner. The pummage passes out freely on all sides, and falls into a vat beneath. A dress is given to the stones similar to grist mill stones, only rather deeper. Circular pieces of cast-iron, properly shaped as before described, or blocks of wood faced with cast-iron, or rods of wrought iron firmly bolted on the face of the said blocks, so as to give them the appearance and effect of dress, may be used instead of stones. The stones may be more or less concave or convex, as it may be desired to have the apples more or less rapidly passed through the mill. The diameter and dimensions of the stones may be varied to suit convenience, and the power intended to be applied. Less power is required to propel the mill when grinding apples than when grinding grain.

David D. Demarest.

Specification of a patent for a machine for the Cleaning of Paper Rags, by which great expense and labour are saved. Granted to William Debit, *East Hartford, Connecticut, January* 13, 1829.

Attach several knives horizontally to the ribs of the screen, or duster, which may be varied in number, length, and width, according to the size of the screen, or duster. The screen, or duster, then revolves in the common way, by water or other power, on hollow axles. In addition to this, an iron shaft passes through the centre of the screen, or duster, and hollow axles; this shaft has a number of knives inserted in it, which are secured by wedges, or nuts, and revolves in a contrary direction to the screen, or duster. Twelve knives in the iron shaft, and six knives on the ribs, I have found well adapted to accomplish the object; with a revolution of the screen, or duster, from 15 to 20 times a minute, and of the iron shaft, from 40 to 50 times a minute, but the exact number of either is not thought to be material. The drawing deposited in the patent office, will show the improvements, as well as the external form of the screen, or duster. The latter, of course, is not claimed as my in-

vention. By my improvement, there is effected a great saving of labour in the cleaning of rags, and preparing them for use in the manufacture of paper. WILLIAM DEBIT.

Remarks on an article in the Journal of the Franklin Institute for February last, on Fulminating Powders, and their use in Fire Arms. By JOSHUA SHAW, ESQ.

TO THE EDITOR.

SIR,—I am induced, from reading an article in the Journal of the Franklin Institute, on the subject of certain fulminating powders, written by Lieut. P. Schmidt, of the Prussian service, to send you some remarks, which are the result of much experience upon the point in question. I hope, however, that you will not expect from an operative artist, any thing which is very systematic or scientific, for in this case you will be disappointed, as I am equally far from possessing either the ability or the inclination to furnish it. To me, and to many more practical men, the learning which writers appear anxious to evince, seems to predominate over every thing else, and thus to destroy the utility of their labours. It is in vain to attempt to give instruction, excepting a language be used with which the pupil is in some degree familiar.

In the paper to which I have alluded, Lieut. Schmidt, in speaking of the powder made from oxymuriate of potash, sulphur, and charcoal, observes, that it is made by adding together twelve parts of sulphur, ten of charcoal, and one hundred of the oxymuriate, and then proceeds to give the result of his experiments. My object at present, is, not to treat of the best mode of preparing the different fulminating powders, but rather to correct the false statements which are made respecting the utility of the different kinds. I will observe, however, that from long experience, I can aver that the proportions above given are not such as will produce the strongest powder from these materials.

It is perfectly clear to me, that at the time the Lieutenant wrote, the subject was new to him, and, indeed, he speaks of the recent use of the copper caps in Germany. I have been in the habit of using copper caps for at least thirteen years, and for the last seven years have manufactured and sold them, at the rate of two millions annually. After speaking of various contrivances, he says, "besides these, other devices have been used for the purpose of igniting this kind of powder, yet they have all their defects, and offer so many difficulties in practice, as to have prevented their general introduction." It would then appear that we are, in this respect, much in advance of Germany, as we have had the prepared caps in almost universal use, for many years, and have never met with the difficulties complained of; this may have arisen, in a great degree, from our having fewer prejudices to contend with than the inhabitants of that country.

Lieut. Schmidt alludes to the observations of Mr. Wright, of

London, on the use of fulminating mercury, mentions his mode of filling the caps with this material, by means of an ivory rod. to which he objects as being both laborious and dangerous; he then recommends a plan of his own, as being much more safe and expeditious. Although this may be a subject of serious discussion between England and Germany, it must here create a smile only. The Lieutenant speaks of filling several thousands in *a week;* by means of an apparatus which I have invented, and long had in use, a little girl fills several thousand in the course of a few hours, every morning. In about four seconds, 500 of the caps are collected together and arranged for filling, and in about the same time an equal quantity of the powder is deposited in each; it is then, with great rapidity, secured by a cement which renders it impervious to water.

It is said that difficulties have been experienced in England, in igniting gunpowder, by the fulminating mercury, and it appears that the labours of the German professors upon this subject, have resulted in their drawing conclusions altogether erroneous respecting the kind of fulminating powder which should be used in fire-arms. Fulminating silver may be considered as out of the question, on account of its price, and need not, therefore, be further noticed. With respect to that prepared with the oxymuriate, its destructive effects are such, as to forbid its use entirely. It soon rusts the lock, penetrates the pores of the iron, rendering it carious, and, consequently, liable to burst. We have long since abandoned the use of it altogether, and are not likely to resume it, in deference either to English or German opinions.

It is plain that Lieut. Schmidt mistakes the meaning of the word *effect*, as used by Mr. Wright. The fulminating quicksilver makes a louder report than the ordinary fulminating powder, but will not fire the magazine at so great a distance. Its fire is rapid, but not elastic, or expansive, as it quickly condenses, and returns to the state of mercury: it is, however, certain, and presents no difficulties whatever.

The most extraordinary part of the statement is, that the fulminating quicksilver is more corrosive than the oxymuriate preparation! With what difficulty do we sometimes arrive at the most simple truths. Nothing can be more gratuitous and false than the above conclusion. Mr. Forsyth of England expended, it is said, a hundred thousand pounds in his attempts to establish the use of the percussion magazine lock, in which he failed altogether, from the corrosive effects of the powder; the whole 14 years of his patent were devoted to this point. As soon as this period had terminated, Mr. Wright introduced the fulminating mercury, since which there has been no complaint whatever of the corrosion of locks and barrels, excepting from the use of imported caps, charged with the old materials.

The cement used, is a point of much importance; gum benjamin and gum arabic, have been principally employed; the first is always soft, the latter attracts moisture; neither of them answers well. The French, to obviate the defects of both these, sought the remedy by

enlarging the caps at the bottom, so that when the powder is introduced and dry, it is, as it were, dove-tailed in, and a smaller quantity of either of the foregoing ingredients will retain it. This lessened, but did not remove the evil.

In America, the percussion gun has, in consequence of the manner in which the caps have been made here, been more generally employed than in England, although the guns themselves are the manufacture of that country. We have, it is true, ran counter to the rules established by the German officer and professors; for, although we may be less scientific in these matters, we know enough of the amusements of the field, to derive from our experience that information which suits us better than the most learned theories, and we even venture to adopt the suggestions of the former, although opposed by the deductions from the latter.

Should you think proper, sir, to give this a place in your Journal, I shall again request a small place for some future observations, containing the practical results of my own experience, as it may interest a certain portion of your readers.

Yours, &c.

JOSHUA SHAW.

Philadelphia, March 20, 1829.

Remarks by the Editor.—We are glad that Mr. Shaw proposes to make some additions to the foregoing, as without such an intention we should not think the subject usefully handled as regards the public. What has been given, we are disposed to consider merely as a preface to what is to follow, and under this impression we have willingly inserted it. Mr. Shaw has told us that the recipe of Lieutenant Schmidt for the fulminating powder is not the best; that the modes of filling caps previously pursued, are inferior to his; that he has a more perfect cement than any which has been heretofore used, &c. &c.; all of which we are prepared to believe, and do indeed admit as a fact, and we hope that his next paper will be one of recipes and processes. We know that Mr. Shaw is able to communicate much useful information, and we presume that his next paper will justify this judgment in the opinion of our readers.

ENGLISH PATENTS.

To WILLIAM HALL, *Merchant, for his invention of certain improvements in Machinery, or Apparatus, for Propelling Vessels.* Enrolled June, 1827.

THE object of the patentee, is, to dispense with the ordinary paddles employed for propelling vessels, and, indeed, of all machinery or apparatus applied on the outside of the vessel for the purpose of rowing or driving the vessel forward, by the mechanical force ex-

erted by paddles or oars against the water; to substitute in place of such contrivances, a jet or volume of water, driven out with force in a horizontal direction at the stern, the reaction of which against the water shall produce the impelling effect required, and drive the vessel in the opposite direction.

In the lowest part of the vessel below the water line, a cylinder is placed vertically, which is open at the lower end to admit water into it through an aperture in the bottom of the vessel, but having a grating to exclude weeds, or any other floating substances. The top of this cylinder is closed with a cap, and rendered perfectly air-tight. Within the cylinder there is a large screw placed vertically, the edges of the worm of which nearly touch the periphery of the cylinder. The screw is intended to revolve upon its axis, or upon pivots at top and bottom, and acting in the way of an Archimedes pump, to raise and force the water through the horizontal tube above-mentioned, which leads from the upper part of the cylinder.

The screw pump is made to revolve with great rapidity by a rigger affixed to the upper end of its axle, which is driven by a band, leading from a steam engine. A jet or volume of water is, by these means, projected with great force from the stern of the vessel, and by striking against the surrounding mass of fluid, in which the vessel floats, causes the vessel to be propelled forward, that is, in the opposite direction to the jet.

It is proposed, under some circumstances, to employ reciprocating pumps to be driven by the steam engine within, which shall raise a volume of water from the bottom, and force it out at the stern.

The attempt to propel vessels by the force of a jet of water driven from the stern, is not new; various modes of effecting this have been devised. Mr. Stedman Adams, of America, in 1811, obtained a patent for such a contrivance; and in 1820, Messrs. Lilley and Fraser obtained a patent for the same object (see the second volume of our first series, page 101.) If there is any novelty in the present plan, it is the introduction of the screw pump in a vertical position, for raising or forcing the water; although paddles of this form have been applied horizontally on the outsides of vessels. There is, however, no question but that the power expended in this way to raise the water, will have a considerable less beneficial effect than if applied directly to the working of paddles. [*Lond. Journ.*

To James Gilbertson, *Grocer, for his having invented an improvement, or improvements, in the construction of Furnaces, by which they consume their own Smoke.* Enrolled March, 1828.

The patentee says, that his invention "consists in the construction of furnaces, with their sides made of hollow plates of iron, in order that a current of air may pass through them, and in its course become heated, and then be discharged into a cavity or ash-pit,

formed at the back of the fire, whence, proceeding through a grating affixed at top of this cavity, it comes in contact with the smoke and flame of the fire, and causes an almost complete combustion of the whole of the fuel employed.

"In large furnaces, where a great quantity of air is necessary, I make a portion or the whole of the bars hollow; but I do not claim any invention in this application of hollow bars, only as in aid of the effect to be produced by the hollow plates at the side."

It is further stated, that the patentee does not intend to confine himself to any particular form of furnace, as it is evident various modifications may be requisite in adapting it under different circumstances. It appears, therefore, that the invention, to whatever form of furnace it may be applied, consists merely in making two hollow spaces on the sides, for the passage of the air to the back part of the fire, or through hollow bars to the same part of the furnace, for the purpose of directing a small current of air in such a way at the back part of the furnace, as to cause the flame and other heated vapours, to be driven back into the ignited fuel, in order that it may be consumed.

There being no particular novel feature or form of furnace claimed, we are at a loss to discover in what this invention consists, as the contrivance of consuming the smoke of a furnace, by conducting a current of air into the flue, beyond the fire, which shall drive back the flame and smoke into the ignited fuel, has been repeatedly applied for the same purpose, and with good effect; under certain modifications, it forms the subjects of several patents, (see our first series,) Bunton's Patent, Vol. I. page 407; Johnson's, Vol. II. page 440; and, if we mistake not, was first applied by Mr. Sheffield, in 1812. [*Ib.*

To John Meaden, *Coach Maker, for his invention of certain improvements on Wheels for Carriages.* Enrolled June, 1828.

The patentee considers that there would be an advantage in the running of carriage wheels, if their peripheries, that is, their felloes and tires, were made half round on the edge, instead of flat or bevelled, as is the common practice. The improvements herein proposed, therefore, consist in forming the tire, or iron hoop, which embraces the periphery of the wheel, with a convex surface on the outside; it may be semicylindrical, or curved in a smaller degree, as shall be thought most desirable.

The proposed mode of making the tire, is, by passing bars of iron in a heated state between rollers; the one roller having a hollow groove cut round it, and the other, a corresponding bead or rib. The bar being by these means rendered hollow on one side, and rounded on the other, is ready to be bent into a hoop or ring, for covering the periphery of the wheel. A suitable length of bar iron thus prepared, is now to be bent into the form of a hoop, and welded

together; after which, it is placed upon a conical block, and hammered to its true circular form.

The wooden part of the wheel being made, and the periphery or felloes finished to the true circular form, the tire, or iron ring, is uniformly heated all round, which causes it to expand sufficiently to be passed over the wooden rim or felloes, and when this is properly effected, the wheel is lowered into a vessel or pool of water, for the purpose of cooling the iron, and causing it to shrink, which binds it fast to the wheel.

All this, however, is the ordinary process employed in placing an iron tire upon a wooden wheel, and the only feature of novelty claimed, is the rounded form of the tire, which, it is thought by the patentee, will be found greatly preferable to the flat bar iron, with which carriage wheels have been heretofore shod. [*Ib.*

To JOSHUA JENOUR, JR., *Gentleman, for a Cartridge, or Case, and method of more advantageously enclosing therein Shot or other Missiles, for the purpose of loading Fire-arms and Guns of different descriptions.* Dated November 28, 1827.

MR. JENOUR'S cartridge, or cartouch, is composed of wire netting, the meshes of which, as represented in the drawing to which the specification refers, are about a quarter of an inch across. It must, of course, be made of a size proper for fitting the barrel of the fire-arm, with which it is to be used, and long enough to contain the usual charge of shot.

This cartouch may be employed in two different modes. In the first, it is to be enclosed in a case of thin paper, with wadding placed at each of its ends, ready for being inserted into the barrel of the fire-arm; and in the second method, it is to be dropped into the barrel, immediately after the charge of powder and its wadding are rammed down. The proper quantity of shot is then to be poured into it, and a second wadding over all will complete the operation.

The intention of this wire cartouch, is, to cause the shot to keep closer together after the discharge, and at the same time to leave spaces between the meshes for its passage in its ultimate dispersion.

The patentee states that the finer the meshes of the wire net are, the closer will the shot be kept together; and that fine sand, or other hard powder, put in between the interstices of the shot, will increase its effect.

OBS.—We are inclined to think Mr. Jenour's wire cartouch preferable to that for which he obtained a premium of fifteen guineas, a few months ago, from the Society for the Encouragement of Arts, an account of which is inserted in our fifth volume, p. 233, present series, where several experiments are related, that prove the advantages of the method, and which are also applicable to the present cartouch. We also think this latter cartouch will occasion less

trouble in its application, and may be managed with considerably more facility than the former.

A third method of using the wire cartouch occurs to us, that in some respects seems preferable to the other two already mentioned, which is, to put the thin paper case *inside* the wire cartouch, an arrangement that probably would cause the shot to be less dispersed by the discharge, than if the paper case were placed outside, as directed in the other method.

The word cartridge used in the specification being evidently a corruption of the French, *cartouche*, (that is, derived from *carton*, the stiff paper, or thin card, of which the article is usually made,) it appears to us, that of the two English words employed for it, cartouch is the most legitimate. [*Rep. Pat. Inven.*

To RENE FLORENTINE JENAR, *Gentleman, for his invention of a new method of filling up with Metal, or other suitable material, the Holes or Interstices in Wire Gauze, or other similar substances, which he denominates Metallic Linen.*—Enrolled January, 1828.

THE proposed mode of filling up the interstices of wire gauze, so as to render it impervious to air or liquids, is, by immersing the said gauze in melted metal, and causing that metal to adhere to the wire so as to close the aperture, and form a perfect plate.

In order to effect this object, it is to be observed that the gauze must be made of such metal or alloy as will not melt at so low temperature as the metal in which it is to be immersed; and in performing the operation, great care must be taken that the wire gauze is perfectly cleansed from all impurities, before it is introduced into the melted metal.

The usual fluxes must be made use of in order to cause the metals to adhere. For instance, sal ammoniac must be employed, where tin is the metal by which the interstices are to be closed. If copper, then borax; and for any of the other metals, the same fluxes as are commonly applied to the purpose of soldering or brazing.

The operation is this. Suppose the gauze be made of iron wire, take a piece of it, about one foot square, and having cleansed and trimmed it in the ordinary way, make a hot metal bath, of two parts tin and one part lead, and fix to the gauze two pieces of iron as frames or handles, at each extremity. The operator then takes hold of the gauze at each end by tongs, and while another person skims off the oxide from the surface of the metal, he plunges the gauze in the melted metal in a horizontal position, and then continues moving it gently backwards and forwards, for two or three minutes. He must then slide the ends of the gauze to and fro, out of the bath, in order that the metal might crystallize, and when the meshes or interstices of the gauze are all filled up, it may be withdrawn altogether, taking care that the motion is continued until the metal has set evenly.

The temperature to which the bath should be heated must depend upon the metal used. Its proper heat may be ascertained by occasionally dipping a piece of gauze into it, and observing when the crystallization appears sufficiently perfect to warrant the immersion of the article intended to be filled up by that metal.

Another mode of effecting the same object, is by means of moulds instead of immersion. Suppose it be requisite to fill up the interstices of a dish cover of a hemispherical shape, to be made of wire gauze. A mould is to be provided, of the exact shape of the dish cover; such a mould as is usually employed for pressing wire gauze into its form. The matrix of this mould is to be the bath containing the fused metal, the surface of which being skimmed over to remove the oxide, a sheet of the wire gauze, properly cleaned, is to be laid over the matrix, and the counterpart of the mould forced in, so as to press the wire gauze into the hemispherical form, the superfluous metal, of course, flowing over. In this situation it is to be kept until the metal is cold, and on being removed from the mould, it will be found that the interstices are closed, and that the cover is perfectly formed.

The patentee also contemplates filling the interstices with potter's earth. To effect this object, the earth or clay must be brought into a fluid state by mixing it with water, when the article being dipped into the liquid, it will adhere, and the interstices become closed. If one immersion is not sufficient, the same must be repeated until the interstices are perfectly closed; and when the clay has become dry, the article so treated may be baked in the usual manner.

Another mode of closing the gauze is by placing a thin sheet of soft metal upon the gauze, and pressing them together with great force, so that they may firmly adhere, and the effect produced after polishing the surfaces of the metal is very beautiful.

Paper or shavings may also be employed to fill up the interstices of the gauze by means of paste; or tortoise-shell or horn may be applied, it being first heated, to render it soft, and then pressed with very great force.

It is also proposed to fill the said interstices with glass; in doing which a sheet of wire gauze, prepared very smooth, is laid upon a plate or pane of glass, and these are put into a furnace together, and heated gradually, until the glass becomes soft; they are then laid upon a table or slab, and with a polishing tool the wire gauze is pressed into the glass. After which they may be annealed in a proper furnace in the ordinary way.

The patentee concludes by saying, "I do not restrict myself to the modes hereinbefore described, of filling up the interstices of the gauze, for I know that there are many other ways of effecting the same object; though I have found those methods hereinbefore described to be the best which I have tried. But I claim, as a new invention, the filling up of the interstices of wire gauze or wire net, with the various substances hereinbefore described, so as to form solid plates, sheets, or surfaces, for the purpose of various manufactures." [*Lond. Journ.*

To ROBERT MOORE, *Distiller, in consequence of communications made to him by certain foreigners residing abroad, and discoveries by himself, for certain improvements in the process of preparing and cooling Worts or Wash, from Vegetable Substances, for the production of Spirits.*—Enrolled January, 1828.

THIS invention consists, first, in preparing worts from grain or other vegetable substances, washed in the state in which it comes from the mill stones, which washing is to be performed in a vessel, without a drain or bottom. Secondly, in cooling worts or wash, for the purpose of fermentation, by the addition of water, at a low temperature.

The grain or other vegetable matter, with all the husk, as it comes from the mill stones, is put into a vessel with a close bottom, where it undergoes the operation of washing. After having cooled it down, it is then fermented with the husky matter mixed up in it, and when the operation is complete, it is sent to the still.

The cooling of the wort or wash, is performed by the addition of water, at a low temperature, immediately before the yeast is introduced; the quantity of water required will be only so much as will reduce it to the proper temperature for fermentation, which is known by every practical brewer, and depends upon the density of the worts or wash.

By this method of operating, grain may be used in a state which will yield a better quality of spirit, than can be obtained by the ordinary means; there will also be a great acceleration of the process, and the cost of utensils employed in cooling will be saved.

The patentee says, "I do not claim the use of a vessel, without a drain or bottom generally; but I claim, as the said invention, first, the process hereinbefore described, of preparing the worts, viz. from grain or other the like vegetable substances put into a vessel, without a drain or bottom, with all the husky matter, just as it leaves the mill stones, and washed in that state in such vessel; and secondly, the process hereinbefore described of cooling worts or wash."

[*Ib.*

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*An Historical Account of Lithography; together with some important improvements recently made therein.**

THE word *lithography* is composed, as every scholar knows, of two Greek words, the one signifying a *stone*, and the other *writing* or *drawing;* that is to say, the tracing upon stone any writing or design from which it is wished to obtain a great number of copies.

* Translated for Gill's Technological Repository, from Ferussac's *Bulletin des Sciences Technologiques,* in its notice of the unpublished work, *Mémoire sur quelques ameliorations apportées a l'art de la Lithographie.* By M. M. Chevalier and Langlume, of Paris.

This art, invented by a singer in the theatre at Munich, named *Senefelder*, was not, in its beginning, a very promising discovery: because it could only furnish products so coarse as not to compare with engravings upon copper; although it may now be said to rival, nay, we may add, even to surpass them in many cases.

It was about the commencement of the present century, that Senefelder began his first experiments, but he kept his processes secret; and imperfect as were the proofs multiplied at Munich, still the men of science and lovers of the arts judged therefrom, that in the hands of those who were able to improve the art, it promised the greatest advantages; and the government of Bavaria accordingly engaged to remunerate the inventor for any ideas he might be able to communicate thereon. Senefelder, thus supported by the government, founded an establishment in the year 1805, into which no stranger was allowed to enter, and which was directed by Senefelder himself.

In 1806, the French armies were in Germany; general Lomet, an indefatigable and learned man, and the best *technologer* which France possessed, arrived at Munich; he procured prints, stones, and lithographic crayons, and also obtained some information on the construction of the presses; and during the years 1806 and 1807, he executed some designs at Passy and Brannau, which he brought with him into France in the month of February, 1808. He was eager to communicate to every one the information he had thus collected respecting this novel art; he showed the prints and other proofs to all the world; but found every one so incredulous respecting it, that he could get no one to assist him in carrying it into effect.

M. Molard, senior, then Conservator of the Arts and Manufactures, was among the number of the incredulous.* The general placed in his hands, in order that it might form part of the collection, a lithographic stone of eight inches by ten, and bearing a drawing which he had executed upon it at Brannau, in the year 1807, and from which he had taken 500 impressions; thus confirming the success of the processes he had employed. M. Molard was then engaged with a new method of striking *en cliche*, for the improvement of vignettes for typographic printing; and he doubted at that time whether the art of lithography would ever be capable of any useful applications.

This disappointment obliged M. Lomet to withdraw his stone, and to seek for amateurs and artists who might be more favourably disposed to receive this happy invention, and which he wished in 1808 to see adopted and practised in France, as well as in every other enlightened nation in Europe.

M. Denon, director of the Museum of the Arts, was made acquainted with it; he was an excellent judge in this matter, but regretted that his occupations and his travels rendered it impossible for him to pay particular attention to it.

* This information is derived from an excellent Memoir, in manuscript, which M. Lomet presented me with about six months previous to his death, and which I shall shortly publish. A work so valuable ought not to be lost.

M. Landon was made acquainted with all that M. Lomet had brought with him from Germany, and greatly admired all the products of this novel art; he did not, however, think that he could apply the discovery to a work which he was then undertaking, a description of the Museum, but he considered that its merit entitled it to the most serious attention.

M. Gilet de Laumont, inspector-general of Mines, and who was a stranger to nothing which concerned the arts and sciences, saw at once the benefit which they might derive from lithography; and in proof thereof, expressed a desire that M. Lomet should form an establishment at Paris. Numerous individuals, no doubt, would also wish to be furnished with lithographic presses, as was his intention; but the functions with which he was charged, as a superior military officer, and the necessity he was under of following the army to Spain, rendered it impossible for him to carry his intentions into effect. He, however, deposited the stone in the Museum of Natural History, of the *Jardin des Plantes*, where it figured amongst the calcareous stones.

It was not until six years afterwards, in 1814, that M. Engelmann, of Munich, established, in Paris, one of the largest lithographic establishments, bringing with him all the processes employed in the workshops of the cradle of this important art, which had remained nearly stationary until this period. The improvements which it has since received, are due to the increasing skill of our artists, who have both designed the subjects for it, and improved the processes. But it is within these three or four months only, that the lithographic art has received its chief and greatest improvements. We shall show the basis on which the lithographic art is founded:—

First, we make choice of a calcareous stone having a very fine grain, but susceptible of giving a firm adherence to the tracings made upon it with a fatty crayon, and with which the outlines of the prints we would produce are drawn; it must also be capable of becoming impregnated with water, which it must retain in its pores during a certain time.

Secondly, the stone must be such, that when it is wetted, it shall not contract any adhesion of the printing ink, excepting in those parts which are covered by the strokes or touches of the fatty crayon.

And thirdly, that when the stone is more or less covered with the design, traced by the fatty crayon, impregnated with water, and charged with the printing ink, on impressing it with a sufficient force, it shall be capable of transferring to a moistened paper, the greater part of the ink which covered the lines made by the crayon.

Lithographic stones have been, hitherto, brought from the neighbourhood of Munich, along the Danube, and near Pappenheim. They have been also found in France, but these do not possess all the qualities required by skilful lithographers; they do not afford surfaces of sufficient size, neither is their grain throughout of a homogeneous texture, fit for large subjects. The best stone has the following qualities:—first, its tint should be a whitish yellow, the yellow being uniform and without spots, threads, or veins, in it.

Secondly, its hardness should be sufficient, but without being too great, so that it may readily be scratched with a point of steel when necessary.

Thirdly, the splinters struck off it by a hammer, should have a conchoidal fracture; that is to say, the broken part should present a hollow on one side, and an elevation upon the other, like a shell.

Fourthly, its grain should be fine, and when wetted with a sponge filled with water, it should retain it for a sufficient length of time.

The advantages which the quarries in the neighbourhood of Munich possess, in affording a facility of procuring the stones, is great, as they are found in beds, and of an equal thickness, so that they do not require much labour in working them. They give them a regular shape by means of a saw.

The first work is to dress the stones, and give them a proper grain. The operation of dressing them is the same as that employed in grinding looking-glasses. The stone is laid upon a horizontal table, and rubbed all over its face in a circular manner, with another piece of stone, between which and the undermost stone there is interposed finely sifted sand and water. The grain becomes the finer, the longer it is rubbed, and the finer the sand is. The different kinds of work for which the stone is destined, require different dressings and grainings. We examine the grain from time to time, by raising the moveable stone, and blowing strongly upon the surface of the finer one, to drive away the excess of water, and then view its surface obliquely.

Upon the good quality of the *lithographic crayons*, likewise greatly depends the beauty of the work. They should adhere firmly to the stone in such a manner as not to be detached under any ordinary circumstances. They ought to be sufficiently hard for the designer to obtain a fine point, so as to draw delicate and well marked lines, without their breaking; if they are either too dry or too porous, they break in an instant: if they are too soft, they become crushed, and form coarse and confused strokes.

It appears that every artist adopts a particular receipt for his crayons; we shall confine ourselves to the describing that which MM. Bernard and Delarne employ with success.

Pure white wax (of the first quality) - -	4 parts.
Soap, dried, made of tallow and soda - -	2
White tallow* - - - - - - -	2
Gum-lac - - - - - - - -	2
Lamp-black† - - - - - - -	1
We also add of copal oil varnish - - -	1

We first melt the wax over a slow fire, and then add by degrees, and a little at a time, the gum-lac, broken into small fragments, incessantly stirring all the while with a spatula; we then mix in the

* In winter, double this quantity should be used, in order to diminish the hardness of the crayon, caused by the lowering of the temperature.

† M. Lomet advises us not to use the black produced from smoke, but instead thereof, to substitute that produced from *charred rags,* which is much finer, and is known by the name of German black.

soap, previously reduced into fine shavings, and when the mixture is perfect, we pour in the oil varnish, with which we have previously ground up the black. We continue to heat and stir it continually, until the paste has acquired a convenient consistence, and which we ascertain by forming a crayon in a mould with it, and letting it becom ecold. We then try it with a penknife, and see whether the parings are brittle. When the paste is sufficiently heated, we form it into crayons, by pouring it into proper moulds.

We do not here intend to give a complete treatise on lithography, nor shall we enter into the necessary details on composing the *lithographic ink*, the *autographic ink*, or preparing the *autographic paper*, &c.;* but shall now proceed to make known the important improvements which have lately been made in this mode of printing.

Since the invention of lithography, the manipulations had not received much improvement until within little more than a month since, when the art received ameliorations of such importance, that we may almost affirm it has acquired a new existence! In order that we may be enabled to appreciate the immense advantages which M. Chevallier, a distinguished chemist, seconded by the talents and the zeal of M. Langlume, one of our best lithographers, have afforded to the processes necessary in the pursuit of this fine art; we must succinctly describe the means hitherto employed, in order to institute a comparison with those which will be used after the precious discoveries of these two benefactors to the art shall have become known. These improvements consist in three principal points, namely: first, in the *acidulation of the stones*, secondly, *in effacing work*, and thirdly, *in re-touching it.*

[TO BE CONTINUED.]

On Filing and Working Metals accurately flat.

[Extracted from Smith's Panorama of Science and Art.]

The large vice must be firmly affixed to the side of the work-bench, to the edge of which its chaps must be parallel, their upper surface being at the same time exactly horizontal. The best elevation for a vice, is that of the workman's elbow, when the upper arm is held vertically against the side; and the lower arm, for the sake of trying the height, is held at right angles thereto. In filing, if the vice or the work be above this position, which is seldom heeded, or even thought of, the stroke will not be so powerful as the same exertion would otherwise make it, and whether higher or lower, it will be found exceedingly difficult to carry the file in a horizontal direction. As the teeth on the inner surfaces of the vice-chaps would mark fine work, if pressed against it sufficiently hard to keep it

* These have been fully given in our recent numbers.

steady, they are, as often as occasion requires, covered with plates of lead, about the eighth of an inch thick. These plates must be large enough to extend about half an inch on each side beyond, and an inch above, the chaps, to each of which, when screwed tight, one of the plates is secured by hammering down the projecting parts.

The handles of hammers are almost always made of nearly a uniform thickness in every part. Hence, the vibrations of the hammers are communicated to the hand of the workman, to whom they convey very unpleasant sensations—he is tired before he has exerted his strength. If the handle of the hammer, at a little distance from its upper end, or that nearest to the hammer, be made considerably smaller, for a short space, than in any other part, so as to spring a little, the alteration will be found a decisive improvement. Such a hammer will fall well, and diminish at the same time the workman's fatigue, convincing him also, that his blows are solid and effectual. For chipping iron, the head of the hammer need not be more than a pound weight, and the handle about a foot long. In a hammer of any given shape, calculated to give the hardest blows with the least weight, and consequently with the least fatigue, the quantity of iron in the head should be equal on the opposite sides of a line, supposed to be drawn perpendicular to the centre of the face. Hammers, therefore, made for the purpose of drawing nails, with claws which lean backwards from this line, are not calculated to produce the best effect in striking. Clock-makers, tin-plate workers, and braziers, polish the faces of their planishing hammers; first, by rubbing them upon a soft wooden board, covered with a mixture of oil and finely washed emery, and they, as well as watch-makers and silversmiths, afterwards remove every scratch left by the emery, and give them an exquisite lustre with colcothar, or putty, applied with water in the same manner.

Metals are sometimes wrought by first chipping them. This operation not only produces the intended effect in an expeditious manner, but saves much expense in the files which would otherwise be required. It is most frequently applied to cast-iron, the outside of which, taken as it comes from the mould, is always harder than the rest, and frequently so very hard, that it would spoil the best file in a few minutes; while at no greater depth than the twentieth part of an inch below the surface, or even less, it is nearly as soft as brass. The chipping chisel will penetrate this hard crust, and afterwards, as may be easily understood, its edge need only be made to act upon the soft part. The flat edged chisel, for this description of work, need not be more than seven inches long, but it ought to be made of the best cast-steel; the hammer to be used with it, has been already mentioned. The chisel is held in an angle of about 45 degrees, and the blows of the hammer are given in quick succession. Some dexterity, certainly, and which can only be acquired by practice, is requisite to preserve a tolerably even surface, but the art is not of difficult acquirement. A pellicle of iron may, by the chisel, be taken from a surface of a hundred square inches in four or five hours, and when it has been well done, the file very speedily levels

the inequalities left by the chisel. When much exactness is required, it is adviseable to examine the work before the chipping is commenced, and if improper protuberances or hollows appear in it, the chisel must either be struck deeper, or not so deep, at such places, as the circumstance indicates.

In the working of metals, there is no operation more common than that of filing, and yet, perhaps, there is none so little understood. A file is an instrument too familiar to every one to need description. To use it well, however, generally proves one of the most difficult tasks which the practical mechanic has to encounter; and this difficulty is owing more to the want of a proper method in setting to work, than to any other cause. Plane surfaces, for instance, for the plates of air-pumps, and a thousand other purposes, are of indispensable use; but a knowledge of the manner in which they may be readily and completely executed, is confined to very few; and a workman aware of the exactness required from him, can rarely be found, who will undertake them. Grinding is the common and dernier resort of those who wish to produce, on such occasions, the last degree of accuracy; but two surfaces of metal may be ground together for ever, without being made plane, unless by some previous operation all their *cross-windings* are completely removed. In the execution, however, of this previous operation, nearly the whole difficulty of the task lies. In what must it consist? Grinding has a tendency to perpetuate any regular convexity or concavity, which either surface may have, and even to produce one or other of these surfaces on each piece, although both were plane to begin with. The application of turning to the production of plane surfaces, is not an easy undertaking, and requires an expensive apparatus; and often the mere fixing the metal to be turned upon the lathe-chuck, takes as much time as ought to be required for the completion of the work. We would incite, therefore, the ingenious artist to place confidence in the *file*, with which we hesitate not to assure him, that more beautiful and accurate workmanship may be executed, than most of those who are in other respects very respectable mechanics, are either apprized of, or disposed to consider possible. In this line of exertion, we have witnessed with admiration the performance of one who held a distinguished situation in the Royal Mint. With files alone, as his cutting and polishing tools, he not only produced specimens of workmanship which challenged all competition and the severest scrutiny, but effected his purpose with a degree of expedition and consequent economy, of which no other method would admit. The work (the appearance of which, though remarkably fine, was only a secondary consideration) required the exact parallelism of its several sides, some of which presented a surface of not less than fifty or sixty square inches; and in his hands the file did all this, in such a manner as to set at defiance the elegant art of turning, and to render the dirty and tedious process of grinding wholly unnecessary. How often, in provincial towns especially, have embryo inventions been kept back, for want of workmen of sufficient skill to execute the proposed contrivances, and how often would inventors them-

selves carry into effect their designs, if they were not filled with the apprehension that the acquirement of a competent share of manual dexterity, was too difficult a task to be attempted! Those who have had the most ample opportunities of observation, will not consider these as idle surmises; they cannot but be sensible that the inventions which become publicly known, are few, in comparison with those which spring up in the minds of ingenious men, and perish from such obstacles as have been just stated, often, perhaps, with the hour which gave them birth. What one man has accomplished, let not another despair of accomplishing also. The want of superior opportunities of experience, are often vanquished by superior exertions; and if these remarks on the excellence obtainable in an art of the first importance to the practical mechanic, should stimulate one person only to the improvement of his skill, they will not be useless.

The practical directions belonging to this subject now claim our attention. Here the general principle, upon the proper application of which success depends, may, in the first place, be noticed; it is simply this: that if a plane surface, already known to be true, could be made use of so as to show with perfect facility and correctness the errors of another upon which the artist may be employed, as often as he wishes to ascertain the state of his work, a file, or any tool by which all the projections may be removed, without reducing the other parts, will enable him at length to bring the latter surface to an exact correspondence with the former. Such a perfect surface, either of stone or cast-iron, is, therefore, indispensably necessary in the art of flat filing; and we may add to it another implement of almost equal utility, though very little used, namely, a perfectly straight steel bar, which is called "*a straight edge.*" These obtained, then an assortment of files follows of course, as also a vice, or some other method of steadily supporting the metal upon which the file is intended to operate.

Files are differently formed, and of various sizes, for different purposes; their sections being either square, oblong, triangular, or segmental, and their denominations accordingly. That sort of file called the *safe-edge*, (on account of its not being cut into teeth on one of its edges,) and which is flat on both sides, and of an equal or nearly equal breadth in every part, is the best for every purpose to which its form admits of its being applied; and is particularly to be recommended in *flat filing*.

In choosing files, some degree of attention is requisite, and will save much subsequent trouble. A file, the surface of which is twisted in various directions, (a circumstance which very often happens in hardening it,) will constantly deceive the workman, as it will produce nothing but false strokes. The files must, therefore, be chosen free from such an imperfection; but a small degree of regular convexity is not detrimental. The goodness of a file, so far as its shape is concerned, may be readily determined by running the eye along it, in the same way as the joiner examines the straightness of a piece of wood.

It is, perhaps, too obvious to require remark, that the scratches made by a file will be proportionate to the size of its teeth; and that the larger or coarser these are, the greater will be the effect which an adequate force will produce at one stroke. Hence the very evident propriety of commencing the work with the coarsest file intended to be used, and afterwards, in regular gradation, employing finer and finer ones, as it approaches to the finished state. Files may be obtained, the teeth of which are so extremely fine, that they will leave the surface of metal, especially if it be brass, almost as smooth as an oil-stone. These are, however, seldom necessary; and for most purposes, files of three or four different degrees of fineness, are quite sufficient.

[TO BE CONTINUED.]

On improvements in Evaporating fluids, Generating steam, Economising fuel, and Lessening the friction in machinery. By JACOB PERKINS, *Esq., Engineer.*

Mr. Perkins's improvement in evaporating fluids, and generating steam.—Knowing the superior conducting power of metals, for heat, over that of water, Mr. Perkins made the following experiment. He caused two circular blocks of cast iron to be made, with flat bottoms, and a hemispherical cavity in each of them, of about three inches in diameter; one of these cups or cavities he left plain, but he filled the other with conical projecting points of cast-iron, formed at the time of moulding it. Upon heating both vessels to the same degree, and putting water into them; he found, as he expected, that the water in the vessel filled with the metal points, evaporated much faster than that in the other vessel. He next caused some iron cylindrical tubes to be cast, having radiating ribs proceeding from the interior surface of each cylinder all round to the centre of it, where they terminated in thin edges. Two of these he connected with his tubular high-pressure steam generators, and placed them in that part of his furnace where the heat was the greatest. Here, owing to the rapidity with which the caloric is given off to the water, through the superior conducting property of the metal, the tubes never become red-hot, and are, consequently, not so liable to injury from the heat of the furnace, as his other tubes were, whilst they generate steam more rapidly.

Mr. Perkins's mode of economising fuel.—He purchases the refuse, or smaller parts of gas-coke, which he sifts, so as to separate the minuter parts from those of a larger size; the latter he employs as fuel in the usual manner, but the dust he mixes with one thirtieth part of clay and water, and strongly compresses the mass in a cylindrical tube, out of which it falls in cylindrical pieces, more or less long. These he dries upon the top of his furnace, and they are then as capable of being burnt in it as the ordinary gas-coke. By

this means, he has actually been enabled to work his high pressure steam-engine, alone, or without doing any work for twelve hours, at the trifling expense of eleven-pence-half-penny! And, no doubt, the same economy will be experienced, in a proportionate degree, whatever work the engine may perform.

Mr. Perkins's mode of lessening friction in machinery.—He has succeeded in avoiding the necessity of employing oil, grease, or any other lubricator to the piston of the steam engine, in the following manner. His piston is formed of a bell-metal, composed of the following materials:—

Copper	-	-	-	20 parts.
Tin	-	-	-	5 do.
Zinc	-	-	-	1 do.

This, as well as his cast-iron cylinder, is cast under the pressure of a considerable head of metal; by which means, the density and closeness of grain of each of them, is very greatly increased, and, indeed, the cast-iron has as close a grain as wrought iron itself! These two metals he finds to act so as to polish each other in use.

He also uses the same dense cast-iron to form his steam engine crank-axes, and the spindles or axes of his grind-stones, &c.; and he runs the cylindrical necks of them upon bearings formed of his bell metal, placed underneath them, and made with hollow cylindrical cavities, across their upper faces, not exceeding the sixth part of a circle in extent; and yet, upon these very small bearings, his necks run, with a very trifling portion indeed of grease, as a lubricator to them; whereas, as is well known, the bearings commonly in use, are semi-circular.

In this manner, the cylindrical necks of the axis of a large grindstone, employed in grinding large articles, run; and yet, on throwing off the band from the rigger, or band wheel, the stone will make fifty revolutions, at the least, before it stops!

Mr. E. Turrell reminds us, that he was informed by Mr. P. Keir, that Mr. Kinman, formerly of Shoe-lane, London, used always to cast his brass ordnance, for the service of the East India Company, under a considerable head of metal: and this, together with the great care he took in watching the exact period when his metal in the furnace had attained its proper quality, as he ascertained by taking out specimens of it from time to time, caused his guns to possess a decided superiority over others, cast without using those necessary precautions. [*Tech. Rep.*

On Annealing Electrum and Tutenague.

These compound metals require a particular management in annealing them; they ought to be heated red-hot in a fire, made either of fir or deal, without knots; or in one made with the wood of the lime-tree; and be suffered to cool slowly, covered with the ashes.

The *electrum* is a new white metal; now getting into use, as a sub-

stitute for silver, in a variety of ways. The tutenague, or white copper, we have long been acquainted with; it ought to come from China, but we are in the habit of making a metallic alloy in this country in imitation of it; we believe that iron enters into the composition of electrum, and nickel into that of tutenague; but a good deal of obscurity prevails at present, in regard to the particular metals employed in the formation of these two compounds. The electrum is sold for about sixteen shillings a pound in London, and the tutenague for eight shillings.

The selection of fir or deal without knots, is a judicious one, as we well know the injurious effects of the turpentine, abounding in the knots of the pine or fir trees, in generating pyro-ligneous acid when burnt; and which, when in contact with heated metals, acts upon them very powerfully, as we have lately instanced in the case of cast-iron pipes, employed in conveying away pyro-ligneous acid, being converted into a substance resembling plumbago, or blacklead.

We know that an eminent awl-blade maker, of Warrington, in Lancashire, always annealed his steel in fire made of the wood of the ash-tree, and which he considered essential to its preservation.

[*Ib.*

[From the Revue Encyclopédique, of November, 1828, published in Paris.]

NOTICE

Of a defence of the experiments to determine the comparative value of the principal varieties of Fuel used in the United States, and also in Europe. Containing a correspondence with a committee of the American Academy of Arts and Sciences; their report and remarks thereon; and animadversions on the manner in which the trust confided to the Academy by Count Rumford has been managed. And, An answer to "A short reply to 'A defence of the experiments to determine the comparative value of the principal varieties of fuel, &c.' by one of the committee of the American Academy."—[Published in Boston.] By Marcus Bull, *Member of the American Philosophical Society, &c.*

We announced in our 22nd volume, page 38, the interesting memoir of Mr. Bull upon the different kinds of combustibles: a work for which the Rumford prize was claimed from the American Academy of Arts and Sciences at Boston.

The experiments of Mr. Bull were criticised with severity by the academical committee; it was decided that they had settled no one point, that the author of the memoir had assumed false premises, and arrived at false conclusions, and doctrines more dangerous than useful. This decision pronounced in America was equally opposed to the experiments of both worlds; for the philosophers of Europe en-

tirely concur with Mr. Bull. From the details given in the "Defence;" from the correspondence between the author of the memoir and the committee; from the form of the objections and remarks, it may be seen that the committee were more occupied with their own opinions on the subject, than in examining the work submitted to them. We do not doubt their impartiality; we rejoice to perceive that they have been always animated with the most praiseworthy zeal for science; for those who cultivate it, and for the arts which it enlightens and directs; but in the history of academical prizes, this decision, so contrary to the opinion of the scientific world, ought not to be omitted.

Mr. Bull has deserved well of the republic of letters, in bringing this discussion before the public: we may at a future day draw from it some useful warnings; and learned societies, if they continue to distribute prizes, will take care that their judgment shall not be condemned by the *irrefragable authority of the public.*

Franklin Institute.

The twenty-first quarterly meeting of the Institute was held at their Hall, on the 16th of April, 1829.

Mr. Abraham Miller was called to the chair.

The minutes of the last quarterly meeting were read and adopted.

The quarterly report of the board of managers was read and accepted.

In pursuance of the recommendation of the board of managers, it was

Resolved, That monthly meetings of the Institute be held for the purpose of discussing mechanical and scientific questions.

Resolved, That the meetings be held on the fourth Thursday evening in every month.

Extract from the minutes.

A. Miller, *Chairman.*

A. S. Roberts, *Recording Secretary.*

The Twenty-first Quarterly Report of the Managers of the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts.

In conformity with the laws of the institution, the board of managers of the Franklin Institute present a report of their proceedings during the last quarter.

Since their last report, the drawing school of the Institute has been closed for the season. The board have great satisfaction in stating that it has been conducted in an able and efficient manner, has been much more extensively patronized than in some former years, and productive of corresponding advantage.

The mathematical school has also been closed, and to this department, likewise, an increased attention has been directed by mechanics, and a high degree of interest excited, from which the board anticipate the most beneficial effects.

A semi-annual examination of the high school was held on the 12th, 13th and 14th of March last, under the superintendence of the committee of instruction. The order and attention of the pupils, their acquirements in the ancient and modern languages, in mathematics, in geography, and grammar, and in the subjects of their studies generally, were such as reflect great credit on themselves and on their instructers.

The regular courses of lectures have terminated for the season. They have been as well attended as in former years, and have contributed largely to increase the mass of scientific information already diffused through our community. Volunteer lectures have also been delivered nearly every Saturday evening during the past season, comprising a series of lectures on the important and interesting science of geology by Peter A. Browne, Esq., and a number of lectures on optics and miscellaneous subjects equally interesting, by Mr. Leib. The institution is greatly indebted to both these gentlemen.

The library has received several additions since the date of the last quarterly report, by purchase, donation and exchange, comprising some valuable works. The library is kept in the managers' room, which is warmed and lighted every evening, and is open to the members of the Institute. Several of the daily journals are also received.

In the same apartment commodious cases have been placed, for the reception of minerals, which, although not at present scientifically arranged, may be inspected with advantage. Many specimens are yet wanting, which, by a little attention to the subject on the part of the members of the Institute, might be readily supplied, without expense to the Institute, or to the individual members.

From the report of the committee on publications, it appears, that the Journal of the Franklin Institute has been so conducted, as not only to sustain its reputation, but to increase its usefulness, and, as the board believe, under happier auspices. Arrangements have been made for obtaining a *very considerable portion of original matter* for its pages. These arrangements embrace a circle of varied and useful talent, from the resources of which the board have great confidence that the subscribers will derive much valuable information.

In accordance with a resolution of the board, adopted at their meeting on the 12th of March, the following plan for holding monthly meetings of the members of the Institute is proposed for your consideration and encouragement. Much good is expected to result from the adoption of the measure. The personal acquaintance of the members with each other; the familiar interchange of ideas on philosophical and mechanical subjects, and such as pertain to the arts generally; the free discussion of unsettled points, and the concentration of the wandering and fugitive rays of knowledge on any and every subject embraced amongst the objects of our institution. Many

isolated facts are known to individuals, which are entirely useless to them, but which, when communicated, add to the stock of knowledge. No one, it is believed, can attend these meetings without deriving from them some advantage. The minds of few men, indeed, are so sterile as to be incapable of making any contribution to the treasury of useful ideas, and few will believe their intellectual wealth too great to be susceptible of increase.

The plan proposed by the committee appointed by the board for that purpose, provides for the fitting up of the lecture room; the arranging therein the architectural models; the erection of cases, and the placing in them of the apparatus belonging to the Institute; and the convenient fixing of tables.

The order of business at these meetings to be as follows:—

1st. The reading the minutes of the last meeting.

2nd. Donations to the cabinet of models, apparatus, and minerals, received.

3d. Donations to the library received.

4th. Reports of officers and committees.

5th. Unfinished business.

6th. Written communications received and discussed.

7th. Verbal communications received and discussed.

8th. Motions.

9th. Selection of questions for discussion at the next meeting.

At a meeting of the board of managers, on the 12th of March, it was unanimously *resolved* to adopt measures for instituting a series of experiments, to ascertain "the value of water as a moving power, and the relative effects produced by it on (water) wheels of different constructions." This object is one of the greatest importance which has come before the Institute.

It is true, that we are not entirely destitute of information on the subject. The talents and experience of many eminent men have been directed to this end, but the progress of desultory or accidental experience is tardy and uncertain; and the expense of direct and continued experiments, on a scale sufficiently large to produce the most certain results, is too great to come frequently within the range of individual enterprise; but even these have not been entirely wanting. Men whose names are neither unknown or unrenowned in the annals of science, have instituted experiments on the same subject; but however much they have illustrated it by their talents and sagacity, much remains to be effected. To do this, is the object of your board. They do not pretend to arrogate to themselves, either collectively or individually, abilities superior to those of the eminent men who have preceded them in the same path; but they wish to apply, and apply effectively, all they do possess, and hope to be aided by the experience of others conversant with such subjects. They desire, if possible, to establish, by patient, direct and careful experiments, conducted on a scale sufficiently large, the immutable principles which ought to govern our calculations on the point of inquiry; and, lastly, they wish that the honour of effecting it may belong to the Institute,

under whose auspices it originated, and the country of which they are proud to be citizens.

Your board are gratified to inform the Institute that the plan meets the approbation and encouragement of our city authorities, and that another public body has also evinced a disposition to aid and encourage them.

When the importance of the object to a very numerous class of our citizens, in the result of which they are directly or indirectly interested, is considered, the board feel assured that the means will not be withheld, and, as members of the Institute, you are respectfully requested to promote it by all the encouragement you may think it merits. All which is respectfully submitted.

A. Miller, *Chairman, pro tem.*

William Hamilton, *Actuary.*

LIST OF ENGLISH PATENTS

Which passed the great seal, from September 25, *to December* 18, 1828.

To Peter Rigby Wason, Esq. Barrister at law, for his having invented a certain improvement in the article commonly called stick sealing wax—September 25.

To James Neville, Engineer, for his having invented an improved machine or apparatus, for obtaining mechanical power from falls and running streams of water—September 25.

To Thomas Fowler, Stationer, for certain improvements in, or for raising and circulating hot water, hot oils, and other hot fluids for domestic and other purposes—October 2.

To John Brunton, Engineer, for improvements in the apparatus for manufacturing coal gas and coke, and also improvements in the method of arranging such apparatus—October 2.

To David Napier, Engineer, for certain improvements in machinery applicable to letter press printing—October 2.

To Thomas Tippett, Engineer, for certain improvements in the construction and mode of working engines with steam and air, and in the boiler or generator of steam, and in the application of such improved engines to a new method of propelling of vessels and other floating bodies—October 9.

To Samuel Lawson and Mark Walker, Machine makers and flax spinners, for having invented improvements in machinery for preparing and dressing hemp, flax, silk, and other fibrous substances—October 9.

To Henry Duxbury, Gentleman, for his having invented a new machine for splitting hides and skins—October 9.

To Edward Hancorne, Nail manufacturer, in consequence of a communication made to him by a foreigner, residing abroad, for an invention for certain improvements in making nails—October 16.

To William Godfrey Kneller, Chemist, for his invention of certain improvements in evaporating sugar, which improvements are also applicable to other purposes—November 27.

To Joseph D'Arcy, Esq. sole executor and residuary legatee of Charles Broadrip, Esq., deceased, for certain improvements in the construction of steam engines, and the apparatus connected therewith—November 29.

To Edward Dakin Philip, Chemist, for his having invented an improved distilling and rectifying apparatus—November 29.

To Robert Stein, Gentleman, for his having invented certain improvements in distillation—December 4.

To William Brunton, Civil engineer, for his invention of a machine, apparatus, or instrument, to ascertain and register the quantity of specific gravity, and temperature of certain fluids in transit; part or parts of which invention is or are applicable to other purposes—December 4.

To Philip Derbishire, Esq. for his invention of a certain medicine or embrocation, to prevent or alleviate sea sickness, which may be usefully applied to other maladies—December 4.

To Zachariah Riley, Engineer, for his having invented or discovered certain improved apparatus, to be attached to carriages, for the purpose of affording safety in travelling—December 4.

To George Rennoldson, Miller, for his having invented certain improvements in rotatory steam engines—December 4.

To John Hague, Engineer, for having invented certain improvements in the method of expelling the molasses or sirop from sugar—December 6.

To Isaac Dickson, Esq., in consequence of a communication made to him by a certain foreigner residing abroad, and discovered by himself, for an invention of an improved projectile—December 8.

To John Boase, Gentleman, and Thomas Smith, Mechanic, for their having invented certain improvements in machines or machinery for scraping, sweeping, cleaning, and watering streets, roads, and other ways, which machines or machinery may be applied to other purposes—December 10.

To Thomas Lawes, Lace manufacturer, for his invention of an improvement in the manufacture of bobbin-net lace—December 10.

To Charles Cummerow, Merchant, in consequence of a communication made to him by a certain foreigner, residing abroad, for certain improvements in propelling vessels—December 10.

To Abram Louis, Mechanic, for his having invented a mechanical volti subito, to assist the players of music quickly to turn the leaves of music books whilst playing—December 10.

To Samuel Jones, Artist, in consequence of a communication from a foreigner residing abroad, for a new and improved method of producing instantaneous light—December 10.

To Thomas William Channing Moore, Merchant, in consequence of his having received a communication from a foreigner, residing abroad, of an invention of an improved method or combination of machinery for manufacturing hats or caps—December 10.

To Valentine Llanos, Gentleman, in consequence of a communication made to him by a certain person residing abroad, of an invention of an improvement or improvements on bits—December 15.

To John Forbes, Architect or surveyor, for his new invented method of burning or consuming smoke—December 15.

To Richard Williams, Civil engineer, for his having invented certain improvements in the application of elastic and dense fluids to the propelling of machinery of various descriptions—December 15.

To Anton Bernhard, Engineer, for his having invented certain improvements on, or additions to, wheels or apparatus for propelling vessels, and other purposes—December 15.

To John Dicken Whitehead, Manufacturer, for his having invented certain improvements in making, constructing, or manufacturing cartridges, for sporting and other purposes—December 15.

To John Morfit, Bleacher, for his having invented a certain improvement in retorts used by bleachers, and makers of oxymuriatic acid, or oxymuriate of lime—December 15.

To John Slater, Manufacturer of coach springs and axletrees, for his having invented certain improvements in axletrees and the boxes for carriage wheels—December 15.

To John Levers, Machinist, for his having invented or found out certain improvements in machinery for making lace, commonly called bobbin-net—December 18.

To William Stead, Millwright and machine maker, and James Stead, wood valuer, for their having invented a paddle wheel upon a new and improved principle, for propelling steam packets and other vessels—December 18.

To Joseph Charlesworth and Joshua Charlesworth, Woollen manufacturers and merchants, and Samuel Andrew Mellor, cloth dresser, for their having invented certain improvements on, or additions to, gig mills, for the raising and finishing of woollen cloths and other fabrics —December 18.

To James Simister, for his new invented improvements in weaving, preparing, or manufacturing a cloth or fabric, and the application thereof to the making of stays and other articles of dress—December 18.

To Edward Josephs, Merchant, for his having invented certain improvements on the wheels, axletrees, and other parts of carts, wagons, and other conveyances—December 18.

To Francis Horatio Nelson Drake, Esq. in consequence of a communication made to him by a foreigner residing abroad, being in possession of the process for the invention of a peculiar till—December 18.

LIST OF FRENCH PATENTS

Granted in the first quarter of the year 1828.

(Concluded from page 223.)

Pierre Gervais Emmanuel Meunier, and Guillaume Mars, sheet iron manufacturers, for sheet iron measures, for measuring corn, &c. —5 years.

Raymond de Gaston, Ex-Receiver General, Paris, for a smoke machine, adapted at a small expense, to every chimney—5 years.

John Heathcoate, Paris, for improvements in the movement of the bobbins in making bobbin-net—15 years.

Dominique Marie Houlet, and Silvain Riverin, button makers, Paris, for the employment of pieces and remains of whalebone, for making buttons of all colours—5 years.

Maximin Cassagnica, Paris, for an apparatus for preparing and carbonizing peat—10 years.

Louis Baron, merchant, Nismes, for further improvements in distilling—10 years.

Schlumberger, father and son, Paris, for a loom for weaving flax and hemp—5 years.

Jean Louis Jaume, Paris, for a method of baking plaster and lime, and the soil for making tiles, bricks, and slabs—15 years.

Pierre Joseph Paret, mechanician, Montpellier, for a weighing machine—15 years.

Auguste de Boussard, watchmaker, Toulouse, for a superior self-cleansing level lamp—10 years.

Jean Baptiste Bailleul, chemist, Paris, for a distilling apparatus by steam, for extracting the alcohol from dregs of grapes, &c.—5 years.

Lagier, merchant, and Robiquet and Colin, chemists, Paris, for a method of purifying madder—10 years.

Ager & Co., Paris, for a machine for making matches—5 years.

Bandin, senior, Paris, for a new method of transporting and preserving fish—15 years.

Authoine, junior, Paris, for constructing furnaces of free stone, called *Pierre Brabantine*, or *Pierre à feu*—5 years.

Francois Jean Guillaume Dande, Paris, for metallic loop holes in stays, dresses, &c., instead of those worked with the needle—5 years.

Josue Heilman, Mulhausen, for a cotton spinning machine, called *lanterne bobineuse*—10 years.

Zuber & Co. painted paper manufacturers, Rixheim, for a method of printing paper by means of a hollow engraved roller, instead of by hand—10 years.

Francois Benoit Hermier, locksmith, Monteux, for an instrument for scythes to give them the curve—5 years.

Francois Vallett, cloth manufacturer, Lodeve, for a bandage with elastic cushion—5 years.

Sapy, brothers, Beaucourt, watchmakers, &c. for a mill for strengthening, cutting, and lengthening the wire intended for pins and for forming the worm of screws for wood or metal—15 years.

Pierre Bernadotte, and Daubauton & Co., Paris, for making paper of animal substances, called *aporeutype*—15 years.

Lichartier, drawing master, and Labove Delille, cultivator, for a machine for winnowing corn.

Matthieu Casson, billiard table maker, Paris, for a method of making the pockets of billiard tables with grooves, and other improvements—5 years.

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania;

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

MAY, 1829.

On Morocco Leather Dressing.

[Translated from the *Dictionnaire Technologique*, for the Technological Repository.]

[CONCLUDED FROM PAGE 254.]

On dying Morocco Leather Red.—It is difficult to give precise rules for this process, because every manufacturer makes a great mystery of his own method, notwithstanding they all follow processes differing but little from each other. But although we cannot warrant the accuracy of every thing we shall describe, yet we shall endeavour to expose so much of the leading principles of the process, as may safely guide every one to obtain the desired result after making a few trials.

We know that most of the colouring materials are only to be fixed upon the surfaces of the articles to be dyed, by the intermediation of particular substances, known by the names of *mordants;* and that these mordants are varied according to the nature of the articles to be dyed, and also according to the time required. We also know that animal substances combine more readily with colouring matters, than vegetable ones. This premised, we also learn from many authors, that the skins of goats may be dyed red, by means of kermes, or scarlet grains, by lac-lake, and also by cochineal: and we have been lately informed, that a fine red dye may be obtained from madder, but we have no positive knowledge of this latter fact. Kermes, as every one knows, will not produce all the tints of red which are afforded by cochineal, and that they are also less brilliant; but then

they possess more durability: and, before the discovery of cochineal, kermes was always employed for this purpose. We may remark, that as in the Levant, from whence we have derived our manufacture of Morocco leather, they always dye their *gasquets*, or bonnets, with kermes, it becomes very probable, that they also use kermes to dye their Morocco leather with. But we know that the Morocco leather-dressers here, also use cochineal, and which really deserves a preference, on account of the brilliant colours which it affords, with a proper mordant.

Some of the older authors, and particularly Geoffroy, have affirmed that the red colour of Morocco leather, was produced by the use of gum-lac in grains; but we are ignorant of the processes employed, or what degree of confidence they merit. We have, however, no doubt that it is possible to employ it for this purpose, and we are the more convinced thereof, because we have lately substituted the lac-dye produced from it, for cochineal, in most other manufactures; and we should, therefore, probably succeed in employing it in this, were we only to take the pains to make a few experiments on the methods of using it, which is the more desirable, since cochineal has now become so scarce and dear. In the mean time, we shall make known the processes actually followed, as described by several learned authors.

The skins intended to be dyed red, being supposed to be properly prepared, and entirely freed from the lime, but not tanned, are each doubled singly, with the flesh side inwards, and stitched along their edges, as above mentioned, and then dipped into a solution of tin, whose oxide combines with part of the skin, and serves as a mordant for the colouring matter of the dye. According to Lalande, it is alum (that is, alumine,) which serves for a mordant; and he directs us to take twelve pounds of Roman alum for every eight dozen of skins. This salt is to be dissolved in about thirty (French) pints of hot water, and when the solution has become lukewarm, the skins are to be successively plunged into it, and be suffered to remain for a few moments; when they are to be drained, twisted, or wrung, and hung upon a horse, to remove all the folds from them.

The skins being thus mordanted by either of the above methods, and sometimes also by both of them, are ready to be dyed. In order to prepare the dying-bath, they take about ten or twelve ounces of bruised cochineal, according to the size of the skins, and dilute the cochineal with a sufficient quantity of water, to which they also add a little alum, or cream of tartar; they then boil the whole for a few minutes in a copper vessel, and then pass the decoction through a fine sieve, or, which is still better, through a fine linen cloth; they then divide this bath into two several portions, in order to give the skins two successive dips. They put the first half into a turning vessel, of a construction similar to that we have above described for washing the skins in, and then turn it eight or twelve dozen times; they are thus frequently agitated for about half an hour, when they renovate the bath by the addition of the other half of the decoction,

and then proceed to give the skins a second agitation for the same time. When they are dyed, they are rinsed and tanned.

It may be here remarked, that the residuum of this dying bath, although it be not capable of communicating more than a very weak tint to the skins, is, nevertheless, not exhausted of its colouring matter, but still contains abundance thereof; yet in such a state of combination, that the mordant fixed in the skins is not able to take it up readily; and this portion of colour has also less brilliancy. In order to extract the remainder of the colouring matter, the Morocco leather-dressers add to the residuum of the bath, an excess of muriate of tin, or alum, which causes it to precipitate; and they sell this species of carmine lake, whilst still moist, either to the manufacturers of paper hangings, or other persons.

The tanning of Morocco leather, is ordinarily performed with sumach, at least in those countries where gall-nuts are too dear; and they give the preference to that which comes from Sicily, because it contains more tannin, and less colouring matter, than that from other countries, which is a great advantage in dying delicate colours. They usually employ two pounds of sumach for each ordinary sized skin; and two and a half, or three pounds, for those of larger sizes. This operation is performed in a large vat, made of white wood, of a conical form, and which will hold from eight to ten dozens of skins; it is from fifteen to eighteen feet wide, in its greatest diameter, and five in depth. We may readily conceive that these large dimensions are necessary, when we know that the skins are extended like balloons, and that it is, therefore, not easy to manage them in the tanning. They fill this vat four-fifths high with water and sumach; they then take the skins, which had previously been sewn together along their edges, with their flesh sides inwards, before tanning them, and make an opening at one end of them, in order to introduce within them, some sumach and water from the vat; they then tie these openings close with a packthread; and when they are all thus prepared, they are each turned, or swung in the vats, by the power of two men in succession, for a quarter of an hour. At the end of this time, they are removed, and placed upon a kind of bridge, which is fixed over the vat, in such a manner, that the water which drops from them, shall fall again into the vat. They are thus filled and emptied twice in the space of twenty-four hours. When the operation has been well conducted, and the sumach is of a good quality, this time is sufficient for the tanning to be completed in; and when this is done, the skins are unstitched, rinsed, and beaten once or twice with the rammers; they are then drained upon a table, by rubbing them all over with an *etire*, or an instrument formed of a blade of copper, whose edge is more or less rounded, and is mounted on a wooden block, with two handles to it, in a similar manner to the plate of stone above described, and termed the *querce;* and, lastly, they are hung up to dry.

When the manufacturers wish to enliven their red colour, when the skins are about half dry, they pass a fine sponge over them, which is moistened by a solution of carmine, made in ammonia.

Others wet them with a decoction of saffron, which gives them a scarlet tinge.

When the skins are intended to receive other colours, they are tanned rather differently, and the methods vary in different places. At Marseilles, for instance, they put ten dozen of skins into a vat of about seven or eight feet in diameter, and which is made of white wood, with a proportionate quantity of water and sumach; these are turned about all day by four workmen, furnished with wooden shovels; in the evening they are taken out, and placed upon planks, supported over the vat; and when the sumach and water have drained from them, they are laid all night in clear water. This work is renewed during two or three days; but they do not turn them continually, and this time is sufficient to tan them in.

At Paris, they perform this operation in a kind of mills; these are barrels, placed horizontally, and traversed by an axis, with necks, or pivots, upon which is fitted a pinion, which is driven by a toothed wheel, fixed upon another axis, with a winch or handle to it, and is worked by the power of a man. Into these mills the skins are put, with the necessary quantity of water and sumach for tanning them, when they are agitated, or turned, for a sufficient length of time.

Other manufacturers prefer to tan their skins with gall-nuts, and they proportion the quantity of them, which they are obliged to use, according to the time employed in the tanning process, which may be from two to three months. For the rest, they follow the process employed at Marseilles. This is also the method which is followed in the Levant. There are many varieties of gall-nuts; the best are imported from Smyrna and Aleppo; but for tanning Morocco leather, they prefer those which are known by the name of *white-galls*, probably because they contain less colouring matter, and are, therefore, less likely to alter the beauty of the red dye. They employ about a pound of them for each skin. In this tanning process, they commence by mixing with cold water, one-half of the quantity of the pulverized and sifted galls, necessary to be used; they then agitate the mixture a little, and also renew the stirring, when the skins are put in; in about an hour afterwards, they add the remainder of the galls, and suffer the whole to remain at rest for about two hours. They then incessantly stir the skins about for five hours with wooden shovels, and let them remain all night, but they take them out next morning, and after they have allowed them to drain a few moments, they are again put into the bath, and it is strongly agitated anew, to mix the component parts of it thoroughly; after remaining in the bath from fifteen to twenty hours, the operation is finished.

When the skins are tanned, they are cleansed with great care, in order not to hinder the application of the colours with which they are to be dyed. Thus they commence with rinsing them thoroughly; they are then well beaten with rammers, in a vat with water; and finally, they give them a dressing on the flesh side, upon the horse, with a blunt edged knife. After this first dressing, they are put into lukewarm water, and they then give them a dressing on the hair

side, with the *querce*, in order to clear the surface, and to soften it. When the skins are become less hard, they are again subjected to a third dressing, similar to the second.

At the time of dying the skins, they are again steeped in luke-warm water, and are then doubled and stitched together, with the hair side outwards. They generally produce the colour at twice dipping.

Most Morocco leather-dressers dye their colours, with the exception of the reds, in small, long, and narrow, wooden troughs; and they dip their skins at a temperature as high as the workman can bear; and which heat they continue, until they have obtained the required tint. When they have procured the degree of intensity which they wish, they remove the skins from the dye, and rinse them; they impregnate them with a little oil, to prevent them from being hardened in the air, and immediately hang them up, extended, in an airy drying loft; where, however, the rays of the sun cannot reach them; as, otherwise, the colours would suffer from the solar light.

As no colours but the red present any difficulty, and the skins readily take any dye, so we shall only summarily indicate the dying materials employed to obtain any desired colour.

Black is produced by impregnating the hair side of the skins with a solution of acetate of iron, applied by means of a brush; this solution of iron is obtained by digesting old rusty iron scraps in stale or sour beer.

Blue.—This colour is dyed in a vat by the ordinary means. That is to say, the colouring matter of indigo is dissolved in the same manner as is practised by other dyers; nevertheless, a great number of Morocco leather-dressers give the preference to a vat, prepared with indigo, green copperas, (sulphate of iron,) and lime. This dye is made in the cold, and they give the skins more or fewer dips, according to the tint which they would produce.

Violet.—This dye is given by one or two dippings of blue, which they afterwards glaze, by passing the skins through a bath more or less charged with cochineal, agreeably to the colour they would obtain.

Green.—This colour is usually obtained by first passing the skins through a bath of Saxon blue, more or fewer times, according to circumstances; and afterwards through one of yellow, by steeping the skins dyed blue in a decoction of barberry roots, cut small, to which they also add a little alum, to serve as a mordant.

Yellow is made by the above decoction of barberry roots with alum.

It is easy to conceive, that with the help of these primitive colours, and by employing the proper mordants, we can compose all the others; and which, indeed, result from the mere mixture of these first in various proportions. For instance:—

Olive.—To dye this colour, we first pass the skins through a dilute solution of green copperas, (sulphate of iron,) and then through

a decoction of barberry roots; to which may be added, more or less of the solution of indigo, according to the intensity required.

Solitaire and *La Valliere.*—To obtain the dyes known by these names, the mordant is also green copperas; and the skins are then passed through the same bath as is used to dye yellow with. We can obtain colours more or less deep, according to the relative proportions of the mordant, and the colouring material.

Puce colour.—This is made with a decoction of Indian wood. With this dye we give two dips; the first requires a little alum to be added, but the second is made without employing any mordant.

Raisin de Corinth.—If for the second bath of Indian wood, we substitute one of Brazil wood, we shall obtain this dye.

Grays.—We can obtain all these tints by employing the black dye, the blue from indigo, and the red of cochineal; they being used in convenient proportions: but the baths are always very weak.

Before dying all these tints, the skins are rinsed, and wrung, or twisted; or, which is still better, worked and drained on a table by means of the *etire;* and when they are dyed, the hair sides of them should have a slight coat of linseed oil applied all over them with a sponge, in order to cause the polisher to slide over them when they are subjected to the currying; and in order also to prevent them from becoming hard by a too quick desiccation when they are carried to the drying loft.

The last work which is bestowed upon the skins, is, the currying; this serves to bring out their lustre, and to render them supple. This operation is performed in various ways, according to the uses to which the skins are to be applied. For covering port-folios, pocket-books, knife and other cases, they are shaved as thin as possible on the flesh sides; are moistened a little, and are stretched upon a table, with the *etire,* in order that they may afterwards remain quite flat. They are then again removed to the drying loft: or, otherwise, they may be again moistened, and be passed three or four times through a grooved cylindrical press, in different directions, to cross the grain. Those skins which are to be used by shoe-makers, saddlers, book-binders, &c., require more suppleness, and are curried differently. When they are thinned, they are polished whilst a little moist, and a grain is formed upon the flesh side with the *pommelle*, used by the leather-dressers; they are then glazed a second time to restore the lustre which the *pommelle* had destroyed; and, finally, they repair the grain on the flesh side, by raising it slightly with a slice of cork affixed to a *pommelle* of white cork.

An Historical Account of Lithography; together with some important improvements recently made therein.

(Concluded from page 283.)

First, *the acidulation of the stones.* This is the first operation to which the lithographic printer submits stones of all descriptions,

after receiving them from the hands of the designer. Its object is, to open those pores which had become closed in the act of polishing the stones, or during the making of the drawing upon them; and in order to render them capable of absorbing water. This acidulation, which is performed by the aid of a dilute nitric acid, is intended to free the traces of the crayon, or of the lithographic ink, from the alkali which they contained, and to render them insoluble in water. The washing which succeeds, removes the unsaturated acid. They then cover the stone over with a solution of gum arabic, in order to fill its pores, and hinder it from taking the black in the printing ink.

The new preparation is entirely different; we employ the hydrochlorate of lime (muriate of lime,) obtained by completely saturating the hydrochloric (muriatic) acid, with the powder of white marble. After the solution is effected, and it has been filtered, we dissolve in it gum arabic, which must be very white, and free from any other substance. The proportions given by the author, are as follow:—one kilogram* and a half of the hydrochloric acid, the quantity of white marble, in powder, which is sufficient to saturate it, and 367 grammes (twelve ounces) of gum arabic. We then add to the filtered and limpid composition, 92 grammes (three ounces,) of pure hydrochloric acid; bottle it, and reserve it for use.

We pour some of this mixture into a glass vessel, and, by the help of a pencil of badger's hair, we can acidulate the whole surface of the stone with facility and great uniformity; we then let it dry.

This simple preparation affords us many advantages which the old one did not possess, and dispenses with the employment of the large quantity of water before necessary, and which rendered the workshops of the lithographic printers so unhealthy.

This new mode of acidulation, has received the approbation both of the lithographic printers, and of the draughtsmen, who acknowledge that the strongest, as well as the most delicate tints, are now equally fine; and we may remark with satisfaction, that the stones, when thus prepared, remain constantly moist, on account of the deliquescent salt (the muriate of lime,) with which they are penetrated. This is an inestimable advantage in respect to the purity of the design.

But it affords them a still greater pleasure, when they see that by using this liquid, they remove those spots which always formed upon the stone during the taking the impressions from it, and which spread in the working, and caused the tints to become too dark. These spots disappear by the employment of the *saline acid* liquid.

Secondly, *the effacing*. We distinguish two kinds of effacing: the one is the complete effacing, or when we would remove the entire design in order to substitute another for it; and the other the partial one, when we would remove a part only of the design, in order to correct, or change it. In either case, we knew of no other means of effecting our purpose, than by rubbing down the surface of the stone, either in the whole, or in part, by the aid of sand; and

* The kilogram is equal to 15444, 0234 grains, English.

which, at each operation, diminished the thickness of the stone, and, in a little time, rendered it unfit for use. In the partial effacing, we formed hollows, which often, if not always, rendered the impressions defective in the eye of the experienced observer; and we conceive the reason to be, that the partially rubbed away surface of the stone being no longer a plane, cannot be equally pressed on all points.

The means of remedying all these inconveniences, naturally presented themselves to this acute and skilful chemist, and who knew the composition of the lithographic crayon. He perceived that it was sufficient to again *saponify* the substances which composed the crayon, so as to render them soluble in water; and finally, by simple washing, to remove them. The *caustic stone** afforded him this advantage: he dissolved half a kilogram of it in three times its weight of water, and, with a sponge, passed it over that part of the drawing upon the stone which he would remove; he then washed it with plenty of water, and the whole disappeared, without altering the surface of the stone in the slightest degree. He could thus *efface*, with the greatest facility, either the whole, or only a part of the design, whilst the stone did not undergo the least alteration; and he has thus given to it a durability of immense advantage, as it prodigiously diminishes the tribute which we paid to foreigners in the purchase of these stones, and which, in consequence of this new discovery, will now require re-placing but very rarely.

Thirdly, *the re-touching* of the designs drawn upon the stone, has always been, both with the designers and the printers, one of the most difficult operations; and to do which, no method has, hitherto, been proposed, which is exempt from objections. The following is our author's process:—

In 125 grammes (four ounces,) of pure water, dissolve two grammes (thirty-seven grains,) of caustic stone (pot ash prepared with lime.) This alkaline liquid, when spread over the drawing, frees it from the gum which covered it, and the remaining upon it for the space of from one to five minutes, again renders the stone fit to receive anew, the lithographic crayon, which takes instantly, and draws freely upon it.

At the end of this valuable memoir on the improvements made in the art of lithography, the authors not only describe their processes with much clearness and precision, but they also add such proofs of the results of their experiments, as must remove all doubts from their readers respecting the verity of their assertions. Fifteen plates are also subjoined, which show the successive progress, after the effacing and retouching of the works. This memoir is not yet published, but it is addressed to the Institute, and to the Society of Encouragement. It has the double merit of discovering processes of high importance, with a disinterestedness, which is extremely rare, as it disseminates their processes without any hope of reward. Our scientific men, nevertheless, had offered them high rewards in

* The process for preparing this is given at the end of this article.—Ed.

money, for communicating their secrets to them; but which they constantly refused to accept.

An improvement of another kind was also introduced into this art in the year 1827. This is due to M. Séb. de Normand, who has described it in *tom.* XIII. of the *Annales de l'Industrie*, page 175. The following is the author's description of it:—

"At the instant that I first saw the lithographic presses, I conceived the possibility of substituting for the scraper, a roller, or iron cylinder, which promised several advantages. First, it would not move the leather, the paper, nor the stone, as it acts by simple pressure only, instead of rubbing upon the leather, as the scraper does, and thus tends to stretch or elongate it. Secondly, the mode of pressing is the same as that employed in printing copper-plates, and which furnishes the beautiful prints we so much admire. Thirdly, as the pressure or rubbing of the scraper is liable to crease the leather, when we neglect to stretch it again, as required, the paper is displaced—the impression is bad—and the work is spoiled. None of these inconveniences happen with the roller, and we can obtain the same pressure as with the scraper."

In the year 1817, the author constructed a press with an iron cylinder, for a Portuguese, who was about to form a lithographic establishment in Colombia; the experiments which he made with it in Paris, were conclusive; there was not one bad impression made, and the workman could print one-third more in the same time, than with the scraper. In the year 1821, he gave a description of it to a M. Boucher, an ingenious geographer in the war office, and who expressed his satisfaction to the author. In 1819, at the time of the exhibition of arts and manufactures, he described it to an agent of M. Senefelder's, who, in the exhibition of 1823, presented portable presses, in which he made use of rollers, without naming him from whom he had obtained the idea of employing them, but intended to claim them as being one of his own inventions. The author had worked in public, so that every one might judge of the perfection of his prints, and it was astonishing that no other lithographer employed his process. This roller is described with figures in the volume of the *Annales de l'Industrie*, which we have above mentioned. It is now hoped, that the lithographers will acknowledge these facts, and that they will generally adopt a process which not only affords more certainty, and requires less labour, but is swifter and less liable to crease the leather, and thus to hinder the perfection of their work. L.

Remarks by the Editor.—So long since as the year 1822, the Editor, in the first volume of his *Technical Repository*, page 365, distinctly pointed out *the employment of a cylinder for taking lithographic impressions*, as well as for several other important purposes, likewise of his discovery, so that he may fairly put in the claim of giving *prior publicity* to this valuable improvement in lithography.

The Caustic Stone.—The late Dr. William Lewis, F. R. S., in his "New Dispensary," gives the following as the process for preparing the *septic stone*, or *potential cautery*.

Take of potash and quicklime, equal parts; water, three times the weight of both. Macerate for two days, occasionally stirring them, then filter the ley and evaporate it to dryness. Put the dry mass into a crucible, and urge it in a strong fire till it flows like oil, then pour it upon a flat plate made hot, and while the matter continues soft, cut it into pieces of a proper size and figure, like crayons, and which are to be kept in a glass vessel closely stopped. This preparation is a strong caustic. [*Tech. Rep.*

On Filing and Working Metals accurately flat.

[Extracted from Smith's Panorama of Science and Art.]

[Concluded from page 287.]

As most of the articles of manufacture to which the file can be applied, are composed of flat surfaces, and as he who can file a flat surface well, will find no difficulty in executing whatever the file will enable him to do, we shall detail the progress of a block of metal, taken rough from the foundry, till it is brought to a finished state, and supposing a rectangular figure to be aimed at, its surfaces will then, of course, be truly flat; and, according to their situation, either exactly parallel, or exactly at right angles to each other. As somewhat greater difficulties occur in filing iron than brass, and as cast-iron is not, in general, so easy to manage as the other descriptions of the same metal, we shall suppose it to be a block of cast-iron. Merely for the sake of having a definite idea of our subject as we go along, let us suppose it to be nine inches in length, seven in breadth, and one in thickness. On receiving it, the first step is to examine the state of the metal, whether it be hard or soft, warped, or tolerably straight, perfectly solid, or interspersed with cavities. If it prove very hard, which may be known by trying it with a file, it will be adviseable to anneal it, which will greatly facilitate our work: but the outside will still be somewhat harder than the internal part, owing principally to some of the sand of the mould closely adhering to it; this outside, or rind, some workmen remove by chipping in the manner already spoken of; others, who have the convenience, take it off with a large grind-stone, turned by machinery; and others, again, use the file immediately, taking the precaution only of using, in the first instance, a file that is already rather worn, as a new one would be quickly spoiled. Chipping is, upon the whole, the most economical and convenient process; and when, for the removal of imperfections or any other purpose, it is requisite to reduce the block materially, it is decisively to be preferred. If, after the outside has been removed, there appear any cavities, or other imperfections, which are not likely to be removed by the file, and which will unfit the piece for its destination, they may be drilled out, and the holes made by the drill filled with rivets or screws. Small imperfections may be removed, by drilling to the depth of about half an inch, and then driving in a plug made of wire, which

may be fitted in sufficiently tight to bear any degree of hardship, and sufficiently correct to avoid the slightest appearance of a flaw, without the trouble, as in riveting, of making the top of the hole wider than the rest of it. With a view, however, to complete security, some tap the hole they have drilled, and then screw in a pin which exactly fits it; but when this is done, and the screw has a fine thread, in filing the surface level, that part of the thread which is nearest the surface, is apt to break off to the extent of a semi-circle, and thus leave the work imperfect: whereas, when the plug or rivet is well fitted in, the place cannot afterwards be distinguished from the other parts of the block by any other circumstance than the superior brightness of the malleable iron.

As the holes in the piece of cast-iron which are occasioned either by confined air, or the falling in of part of the mould, have mostly not only very rough surfaces, but are wider internally than at the outside, they may be filled with melted lead, pewter, or some other soft metal which they will retain; type metal will answer extremely well, as from the antimony it contains it expands in passing from the fluid to the solid state. This mode is applicable when evenness of the surface is the principal object in view; and it is not necessary to regard the uniformity of its appearance, the equal hardness of its several parts, or its being able to bear a strong heat.

Let us now suppose that the block we have in hand is completely free from its hard coat, and, as far as may be thought necessary, from every imperfection which the subsequent operations with the file are incapable of removing. We now select the file we intend to use first, and in doing this, we pitch upon a *safe-edge* one, about fourteen inches long, an inch and a half broad, and containing about fourteen rows of teeth in each inch of its length. In the act of filing, the file is held by the handle, and pushed forward by the right hand; while the left hand, near the wrist, by pressing upon its farther end, gives effect to the stroke, which must be directed as nearly horizontally as possible. By the occasional application of the straight edge to the surface we are filing in various directions, but in particular diagonally, we easily ascertain the state of our work, and remove in succession the elevated parts. The inequalities at length become so small, that it would be tedious to apply the straight-edge to discover them; but being provided with a flat surface, which we know to be true (and which we shall designate by calling it a table, as it ought always to be larger than the work we are filing, and, for general purposes, may, with much advantage, contain several square feet,) we now make use of it, for the detection of the remaining imperfections, in the following manner:—we mix finely washed red chalk, or ochre, with olive or any other oil which is not viscid, and we rub this mixture upon it with a piece of cloth, so as to cover the whole of it very thinly and evenly.

If the surface we are filing be then turned down upon it, and moved a few times backwards and forwards, it will be every where equally covered with ochre from the table, provided it be equally level. But, as this will never happen at the first trial, those parts

which are highest will alone be reddened, and they must be reduced by the reapplication of the file. As soon as the marks left by the ochre have disappeared, and we think we have removed the inequalities they pointed out, we again try the state of our work as before, and continue to repeat the same process till it is finished. When it approaches nearly to a perfect plane, the ochre will redden a great number of places in small spots or stripes; and then we not only, agreeably to the remark already made, use a finer file, but hold it rather differently. Instead of pressing it down, as when we began, with the broad part of the left hand, we now merely press upon it with two or three fingers, by which means we are enabled to observe more distinctly the spot upon which we bear, and to move with more expedition from one part to another.

Before we begin to finish our work with much nicety, we carefully attend to one thing; turning that side of the block we have been filing, down upon the table, we strike the back of it, at the corners, centres, and various other parts at pleasure, with a mallet, or the end of the handle of a hammer, held perpendicularly. If a dead sound, such as would be heard on striking the table itself in a similar manner, be produced, we feel gratified by the assurance thus afforded, that we have none of those twistings of the surface, which are termed *cross-windings*, to remove; but if a sharp ringing sound be produced, it is evident that the surfaces of the table and the block do not coincide, for the blow of the mallet has pressed one part of the block lower down than it was before, and raised another part; and to the action of the surfaces upon each other thus occasioned, the ringing sound is attributable. If the corner of the block, to the extent of a square inch, or even less, be lower than the remainder of the surface in no greater degree than the thickness of a sheet of common writing paper, this mode of trial will make the imperfection very distinctly perceptible. If, therefore, the block will not stand the test of this examination, we immediately proceed, by the use of the ochre, to detect the extent of the elevated parts, and in moving the block upon the table for this purpose, we are careful to press only on those parts under which we know, by our previous trial with the mallet, they are comprised. Having obtained the marks we desire, we file away to the best of our judgment, the convexities they indicate, and repeat the experiment and filing, till the block will lie perfectly solid upon the table. This object, so essential to good work, being obtained, and it ought always to be obtained as early as possible in our progress, we shall approach with surer steps to the successful accomplishment of our task.

The practitioner, however, will soon discover, that although the test by the mallet answers an important purpose, in proving the existence or non-existence of cross-windings, yet its application extends but little further; the depression of any particular part, before it can point it out, must not only extend to the edge of the block, but must embrace a small portion of at least two sides. Without, therefore, expecting from it what it cannot afford us, we use it merely as a collateral help; the use of the ochre simply, is our universal

test; but if we wish to know the measure of any particular imperfection, we resort to a good straight-edge, the application of which, to any part we choose to try, gives us, with the utmost precision, the information we are seeking. If the surface tried be perfectly true, no light will pass between it and the straight-edge; but if any hollow be present, the breadth and depth of the line of light which appears, betrays its extent.

Let us now suppose that one surface of the block will bear examining in the different ways above-mentioned; it will then coincide with the table so exactly, that when laid upon it, the finest hair could not be drawn out, or even moved, at whatever part between the two planes a portion of it were placed. Notwithstanding this, the surface, though very smooth, has not been nicely polished; the polishing we leave, if not to the last, at least till the opposite side of the block is equally advanced.

The four sides are, likewise, to be similarly worked, calling in the square and callipers to rectify them from time to time; but as it is evident that there is less trouble in effecting these than the broader surfaces, so we do not think it needful to dwell thereon.

If there be those who are more attentive to authority than reason, and who inquire by whom a process is used, rather than what is its merit, we assure them that the method of filing flat surfaces here pointed out, is adopted in the far-famed manufactory of Boulton and Watt, at the Soho, near Birmingham.

Process for Dying and Printing Velvets. By Mr. Schutte, of Cologne.

When velvet is to be manufactured, with a view to its being afterwards printed, it is necessary, in the first place, to bleach the silk intended to be employed in the manufacture, by boiling it in water in which white Marseilles soap has been dissolved. The velvet is, afterwards, made by the common methods, and is again boiled in the same manner, that no impurity may remain.

When the velvet is quite dry, it is extended on tables, and the pile is laid by a simple cylinder; and in this state it is ready to receive the impression which is made in the following manner:—

Whether we wish to give the velvet a uniform colour, or whether we prefer printing it with any sort of pattern, we begin by applying to it plates or patterns filled with a mordant and lined with felt, in order that the colour of the mordant may penetrate. This mordant is composed of a solution of 66 lbs. avoirdupois of Roman alum, in 30 imperial gallons, nearly, of water, and to which are added 15.44 lbs. of acetate of lead, 4.4 lbs. of sal ammoniac, 2.2 lbs. of ground chalk, the same quantity of acetate of copper, 30.5 cubic inches of saturated solution of tin, and 1.1 lb. of arsenic detonized with saltpetre.

After having suffered this composition to rest for forty-eight hours,

starch is mixed with it in the ratio of 1930.5 grains, to 61 cubic inches, for the purpose of giving the consistency necessary for printing.

The velvet on which this mordant has been applied, is set to dry. It is afterwards freed from this same mordant, by being heated with wheat bran to the temperature of 104° Fahrenheit, and then it is washed in running water: no more is now requisite but to make it take the colours intended to be given to it.

If it be desired, for example, to dye it red, black, or yellow, the parts intended to be red having already taken the above mordant, we print the small black pattern with another mordant, which is nothing but common solution of iron; and then the velvet is put into another liquor composed in the following manner:—

Take 4.4 lbs. of Zealand madder, and 6.6 lbs. of wheat bran for every 2.2 lb. of velvet; make this mixture warm in a copper, introduce the velvet, and pass it forward and backward by means of the windlass over the boiler, till the colour becomes dark; rinse it, and wash it in a stream of water, then pass it through a liquor composed of wheat bran and soap, and finish by washing in pure water to expel every impurity.

This madder liquor serves to give the necessary lustre to the red and black colours. It does not act on the parts intended to be yellow, which, through the whole operation remain white, because not having taken any mordant, they could not acquire any colour.

To make these parts yellow afterward, take 3860 grains of turmeric for every 2.2 lbs. of velvet, boil it in water, and immerse the velvet in the liquor till it becomes as yellow as required. Afterwards wash it in pure water, and after having passed it through a warm liquor of oil of vitriol (sulphuric acid,) wash it once more in water.

The turmeric liquor does not act on the black and red colours, which are previously printed on the velvet.

To give velvet other colours than the above, it is necessary to add some other ingredients to the mordant.

To obtain a brown colour, add to the mordant one-quarter, half, or three-quarters of solution of iron, according to the lighter or darker shade desired.

For blue, to each 61 cubic inches of the mordant, add a quarter of that quantity of water, and 448 grains of blue vitriol (sulphate of copper,) dissolved in vinegar: the dying is finished with Brazil wood.

Crimson is obtained by adding to every 61 cubic inches of the mordant, 463 grains of solution of tin, and we finish by dying the velvet with Fernambuca (Brazil) wood, or with cochineal.

Whatever the colour may be, the above process must be followed, observing only that soap must not be employed when woods are used in the dying.

If it be wished to have more than three colours on the velvet, the accessary colours must be applied with the pencil, after the velvet has received the three principal colours.

Before the velvet gets dry, it is extended on gum-frames, and strongly heated from below, by a charcoal fire, and the pile is raised by passing a brush over it rapidly.

If it be desired to give the velvet a certain degree of stiffness, it will be sufficient to rub the wrong side with a mixture composed of linseed, fish-glue, and brandy.

On the best method of Warming and Ventilating Houses and other Buildings. By Mr. Charles Sylvester.

[From the Quarterly Journal of Science, Literature, and the Arts.]

The action of the sun's rays on the surface of the earth, and the consequent accumulation of sensible heat, is a most instructive lesson for the best mode of applying artificial heat for warming buildings; and our best ideas of ventilation are derived from those mechanical changes in the atmosphere, occasioned by the rarefaction of the air, from the heat it acquires in contact with the earth's surface. If the earth were perfectly transparent, or had a surface capable of perfect reflection, it would not be at all heated by the sun's rays; and our atmosphere, supposing it to exist under such circumstances, would be destitute of those changes which are daily evinced in an infinite variety of currents. If the substance of the earth were a much better conductor of heat, we should experience less extremes of heat and cold upon its surface. The summer heat would be more rapidly absorbed by the earth, and the rigour of winter would be much diminished by the heat derived from the earth in the sun's absence. The nature of soils, as regards their conducting power, has, doubtless, a great influence in limiting the extremes of temperature in winter and summer. The heat produced on any part of the earth's surface, will be the greatest where the rays of the sun are vertical, and the surface of such a nature as to receive the rays with the greatest facility, its substratum being at the same time the worst conductor of heat. The air immediately in contact with this surface, becomes heated, and specifically lighter than its superstratum. This causes, in the first instance, two simultaneous currents; one perpendicularly upwards, and the other, a lateral one from all the surrounding parts towards the centre of the heated surface. After the ascending current has attained a certain altitude, it progressively assumes an oblique, and, ultimately, a lateral direction, but in an inverse order to that of the lower stratum. By this beautiful provision of natural economy, the heated air of the torrid zone, and the chilling currents from the polar regions, mutually contribute to the prevention of those extremes of heat and cold, which would otherwise be fatal to every class of animated beings.

To form some idea of the effect which would result from a vertical sun upon a good reflecting surface, such as a black soil, unattended by the currents of air above alluded to, we have only to

observe the heat generated in hot houses; in which case the heated air is, to a certain degree, prevented from ascending, and, consequently, the lateral current from coming in. The heat produced by these means, therefore, will be greater in proportion to the blackness and lightness of the soil, to the tightness of the surrounding walls and windows, and the perpendicularity of the sun's rays. Hence we see the importance of our atmosphere, independently of its agency in respiration. Without it, bodies would receive their heat on those parts only which are exposed to the direct rays, and would become unequally heated in the inverse ratio of their conducting power.

When bodies are immersed in a heated medium, such as in air or water, they receive their heat on every side; and it has been found, by experience, that this mode of applying heat is of particular importance in the economy of animals and vegetables.

Nothing can be more unphilosophical than the common mode of warming ordinary rooms by open grates. To put an extreme case of this mode of warming, we have only to instance the effect of making a fire in the open air. In this instance, there is free access for the ascent of the rarefied current; and the lateral current, rushing towards the fire, is felt on every side, supposing no natural breeze prevailed. The effect of this cold current is so conspicuous on the human body, that few, unaccustomed to such exposure, would escape some variety of those affections called colds.

Our common dwellings approach this extreme case in proportion to the size of the fire, the width of the chimney, and the access of cold air by the doors and windows. In every case, as much cold air must be admitted as will effect the combustion of the fuel, and supply the demands of respiration. The air, which would be barely sufficient for these purposes, coming immediately from a cold atmosphere into rooms with grates, even of the best construction, will ever be a barrier to that comfort which we ought to experience, and which, by the aid of other means, can be easily attained.

Notwithstanding the absolute necessity of admitting a certain portion of fresh air into every room, it is a common practice with builders to make doors and windows so tight as frequently to be the sole cause of a smoky chimney. To obviate this evil, some have let in a certain quantity of atmospheric air under, or near to, the fire-grate. By this expedient, those sitting round the fire, are not annoyed by the cold current; but an inconvenience arises from this contrivance, which more than counterbalances its benefits. The air entering the room so near the fire, immediately supplies the current up the chimney, without changing the air of the room. A crowded room, and the presence of a number of lights, would, under such an arrangement, soon render the air unfit to breathe. Hence will appear the necessity for two currents into a room. The inlet for fresh air should be in a situation not liable to annoy those sitting in the room; the outlet is generally provided for in the chimney, which is commonly sufficient for rooms of ordinary size, but is mostly too small for large public rooms.

It will be evident, from what has been observed, that in order to render rooms comfortable and wholesome, two objects are required. The one is, to keep up a uniform and agreeable temperature; the other, to provide for a change of the air sufficient to preserve that degree of purity essential to health, and which persons under certain pulmonary affections, can so nicely appreciate.

It is evident, that the former of these objects can never be attained by radiant heat; and yet, an open fire, which scarcely affords any other than radiant heat, is so connected with our domestic habits, that it will be very long before the open grate will be entirely set aside. Under these circumstances, it has been found most expedient to use the combined effect of radiant heat with a constant supply of fresh air, raised to an agreeable temperature in the winter; and which, in certain cases, may be cooled during the excessive heat of summer.

Great difficulties have been experienced in most of the means hitherto employed for warming air. In the first place, from what has been previously observed concerning the action of the solar rays on the earth, the air cannot be warmed by radiant heat passing through it; therefore we can only give heat to a transparent fluid by bringing its particles in contact with a heated surface, and, in proportion as elastic fluids are more expansible, they are heated with more difficulty.

There are several properties which a body should possess, to afford a surface proper for heating air intended to warm and ventilate rooms. For the sake of economy, it should be a good conductor of heat, in order that the radiant heat which it receives on one surface, may be freely transmitted to the other. The surface to be heated should be clean, that is, free from any foreign matter, but not polished; and when the temperature can be limited, it should never, under any circumstances, be allowed to exceed 300°. Metals appear to be the best substances for heating air. The temperature is limited to 300°, because the animal and vegetable matter, which is found mechanically mixed with the air at all times, will be decomposed if the temperature be raised a little higher. When this decomposition takes place, as is very observable when the heated surface is red-hot, certain elastic fluids and vapours are produced, which give to the air a peculiar odour, and a deleterious quality, which never fails to affect the health of those who inhale it for a length of time. This oppressive sensation has been mostly felt in churches and other places where large iron stoves are used, and are sometimes heated to redness. The peculiar odour accompanying it, has been erroneously attributed to the iron; and on this account, earthenware, or stone, has been employed to form the exterior surface of the stove. It will, however, be found, that whatever be the material, if the temperature at all approaches a red heat, the same smell will be perceived; as it arises entirely from the decomposition of the matter which is in the air, and not from the heating body. This matter is very visible to the naked eye, in a sunbeam let into a dark room.

When earthenware, or stone, has been employed for stoves, its inferior conducting power has seldom allowed the exterior surface to get sufficiently hot to produce the effect on the air above alluded to. And hence it has been less objectionable as affecting the purity of the air.

It must, however, be admitted, that if the body used for heating the air, does not undergo any change, a metal, from its being a good conductor, must be preferred to any other substance. Silver, or platina, if it were not for the expense, would set aside every prejudice. But long experience has shown, that iron possesses every essential property. The slightly oxydated surface which is common to all iron coming from the forge or the mould, in casting, is well fitted for receiving radiant heat. And if its temperature be kept below a red heat, there does not appear to be any limit to its durability. The latter point, therefore, is put out of all doubt, since it is essential that the iron shall not be heated to a degree capable of decomposing animal and vegetable matter, in order to preserve the purity of the air which is warmed in contact with its surface.

With a view to ensure the above objects, it will be necessary to dispose of the heat as it is produced from the combustion of the fuel, in such a way, that an extensive surface of iron shall be heated uniformly, without the risk of attaining a much higher temperature than 300°. This can be accomplished by making fire of a size proportionate to the interior surface of an iron vessel, and it is found that radiant heat is much more efficacious than the heat produced by flame and conducting flues. Having heated the interior surface of an iron vessel, it may be conceived, that the exterior surface will quickly attain the same degree, and that whatever heat may be carried off from the exterior, will be as quickly given from the interior, and instantly replaced by the radiant fire.

The next material object, is the means of disposing of the heat from the exterior surface. If it be surrounded by an open space, and that be connected with a flue, or tunnel, of a certain height, supposing there to be no inlet at the bottom, or outlet at the top, the air would commence a circulation; that on the heated surface would ascend, and its place be as constantly supplied by the surrounding air. In this way, two currents will be established; one ascending from the heated surface, and the other descending on the outside of the tunnel; and these currents will go on as long as any difference of density exists in the air of the different parts of the surrounding space. If now an opening be made in the bottom of this tunnel, and another at the top, an ascending current will be kept up; which will be as the difference of density between the external air and that of the heated column, and as the square root of the height of the tunnel.

Let D be the density of the external air;

d, that in the tunnel, which will be inversely as the heat supplied.

$V =$ the velocity which a heavy body would acquire by falling through the height of the tunnel; and $v =$ the velocity of the ascending air.

Then $v = V \times \frac{D-d}{D}$. This equally applies to chimneys, d being the density of the smoke.

The mere exposure of the heated surface in an open space, such as a small room, is not sufficient to produce the greatest effect. This is, however, the method at present used by sugar-bakers for heating the rooms in which they expose their sugars. The vessel so employed, is of cast-iron, and is called a cockle.

Various modifications of this method of heating air have been employed. The wall surrounding the heated vessel, has been placed at various distances, in order to find the maximum of effect of a given fire. It was considered a great improvement, to place the wall at a distance, to admit of a sufficient quantity of air, and make a number of apertures in the wall, about two and a half inches square, with a view to compel the air to blow upon the heated surface. This method was employed more than thirty years ago, by William Strutt, Esq. of Derby, in his cotton works. He afterwards made a great improvement on this plan, by inserting tubes in the apertures in the wall reaching near to the heated surface. By these means, the air is prevented from ascending before it comes in contact with the heated surface. A further improvement was made in this apparatus, by inserting similar tubes over the surface of the cockle, the shape of which was a square prism with a groined top. The cold air was made to pass through one-half of the tubes; and the air so heated, became still more heated by being compelled to pass in a contrary order through the other half, into a chamber above, called the air-chamber. The stove, thus improved, has been employed by Messrs. Strutts, in their works, ever since, with complete success, and is similar to that by which the Derbyshire General Infirmary is warmed. This stove has been fixed in different parts of the country, and in London, sometimes with success; but so many circumstances, besides the stove itself, interfere in arrangements of this kind, that the plan has failed in many instances. And such will ever be the case with the best inventions, in the hands of men who are unacquainted with the principles on which they are founded.

[TO BE CONTINUED.]

Method of smoothing the Edges of Razors, by means of the crystallized Tritoxide of Iron, called by Mineralogists, Specular Iron-ore (fer oligiste spéculaire). By M. Merimee.

[Abridged from the Bulletin de la Societé d'Encouragement.]

A certain way to have good razors, is to learn to sharpen them well; and to do this, is much less difficult than to learn to shave. If a little skill is necessary to strap a razor properly, a good strap is indispensable. The various forms in which straps have been made, and the many new and boasted compositions for preparing them,

prove, at least, the importance attached to this operation. It is with a view to render it more easy and certain, that I have determined to make known a preparation which has appeared to me, as well as to all those who have used it, particularly adapted to make the edges of razors extremely sharp. I prefer the flat form for the strap, because I find it more convenient for keeping the edge of the razor in the same plane. The quality of the leather of which it is made, is of great importance. It should be fine grained, of a close texture, giving way equally under the pressure of the blade. As skins of this quality, sufficiently thick, are rarely met with, two pieces may be carefully glued together. To graduate the action of the substances employed to sharpen the razors, the razor strap must have two faces. The powders to be applied on the first face, may be any of the substances which have an action on tempered steel, such as emery, hone, or whet-stone, slate, pumice stone, calcined clay, iron cinders, or scales, &c. The hardest should be preferred, because they will wear the longer. These should be well ground and sifted through silk. Whatever mixture of powders be adopted, it is necessary to add to it some powdered charcoal, which has the effect of preventing the composition from adhering to the razor; and, if added in proper proportion, the razor will slide over it without carrying away the smallest part.

These powders are commonly mixed with grease, into a kind of pomatum, which is applied uniformly upon the leather. It is better to lay on first a very slight coat of grease, to spread the powder on it afterward, and make it adhere every where equally, by rubbing it with the finger. Thus any particles large enough to endanger the edge will be felt, and, by continuing to rub, may be removed from the surface of the leather.

Grease should be preferred to oil, by reason that it does not dry, and that drying oil might sometimes be used in mistake, which would soon harden the leather and render it useless.

To finish the edge of the razor, the powders hitherto employed are colcothar, the finest emery, black-lead, &c. I have tried all these substances, and have found that they produce less effect than a crystallized tritoxyde of iron, called by the French mineralogists, *fer oligiste spéculaire*. What is found in nature may be used, or the artificial may be prepared in the following manner. Take equal parts of sulphate of iron (green vitriol,) and hydrochlorate of soda (kitchen salt;) rub them together in a mortar, fill a crucible with the mixture, and heat it red hot. A considerable quantity of vapour will be disengaged, and the matter will resemble a metal in fusion. When vapours no longer arise, remove the crucible, and let it cool. It will then contain a saline substance of a violet brown colour, covered with extremely brilliant spangles, and perfectly like specular iron.

Dissolve the mass in water, and wash it to carry off the salts, and to separate a more or less considerable portion of uncrystallized oxyde, which by its greater lightness, will remain suspended in the water, while the micaceous spangles fall to the bottom. These span-

gles only are to be kept for sharpening razors. The other portion will make excellent red polishing powder.

To prepare a large quantity, a shallow cupel will be preferable to a crucible, as presenting a larger surface to the air. The fire must not be too violent, nor too long continued; for then the powder would be black, extremely hard, and would produce no good effect. It is so much the better, as it more approximates to the colour of the violet *aventurine*.

This powder should not be mixed with any grease. However, if the strap is new and dry, the leather should be slightly rubbed with tallow and then wiped. It will always be greasy enough to hold the powder. The razor ought to slide over it, without sticking to the leather. When it begins to stick, fresh powder must be applied. The razor should be wiped, before it is strapped on the last side of the razor strap, to finish the edge.*

A simple and easy method of Purifying the inferior kinds of Brazil and Logwood, from their yellow colouring matter. By Dr. Dingler.

[Annales de Chimie, from the Journal Polytechnique of Augsbourg.]

There are many inferior species of Brazil wood, known by the names of wood of Bimas, of St. Martha, of Ancola, of Nicaragua, of Sapan, &c., which are much poorer in red colour, than the genuine wood of Fernambouc, and which, besides, contain a considerable quantity of yellow, or fawn colour, which deadens the lustre of the red, and renders it almost impracticable to apply them with advantage to dying or printing. The genuine Fernambouc wood having become very scarce (in Germany,) and its price exorbitant, it will be interesting to the manufacturer to learn a method of supplying its place by the inferior sorts of wood.

The process is the following: cut or rasp the wood in the usual way, and extract, by boiling in water, all the colouring matter which it contains; evaporate the liquid very considerably, so as, for example, to get all the colour of four kilogrammes of the wood, in 12 or 15 kilogrammes of liquid; then when it is cold, add to this quantity, twelve hours afterwards, two kilogrammes of skimmed milk. Stir the mixture and boil it for a few minutes, then strain it through thick flannel. The liquid will soon become turbid, and all the yellow colour will unite with the curd of the milk and fall to the bottom, whilst all the red dye will remain in the supernatant fluid. If this be wanted for piece-dying, it must be diluted with water before using; but if it is to be employed for block-printing, it should be evaporated to about half its quantity, and then thickened with starch

* Instead of a strap, I have seen a plane metallic plate, an alloy of tin, oiled, employed with great success in setting razors and surgeons' instruments. Leather was objected to, on account of its rounding the edge.—*Translator.*

or gum. If to this be added some solution of tin, or some other mordant to heighten the tint, the artist will have a red, equal, if not superior, to the best Fernambouc, both in lustre and durability.

The quantity of skimmed milk to be used, should always bear a due proportion to that of the colour presumed to exist in the wood. If it is young, and, consequently, poor in dye, two kilogrammes of milk are sufficient for six to eight kilogrammes of the wood; and the evaporation for block-printing, must, of course, be guided by this principle. In making lakes, the manufacturer will easily discover, by the different tints which he meets with, the quantity of inferior wood required to supersede the true Fernambouc.

These decoctions may be used immediately after they are made; nothing is gained by keeping them.

On the kind of Water the best fitted for Fermentation in the Distillery of Corn Spirits. By M. Dubrunfaut, *of Lille.*

[From the Annales de Chimie et de Physique.]

It is a generally received opinion, that rain, or river water, is the best fitted to insure a good fermentation. Those, however, who have doubted this assertion, have contented themselves with saying, that any water, if drinkable, is fit for this object. The former of these opinions, though less accurate than the other, is founded on the superior purity of these waters, so that in many distilleries the supposed preference of these to well-water, is never at all called in question.

The origin of this opinion, is, probably, derived from the unquestionable advantage of a water free from earthy or calcareous salts, in the delicate operations of dying; but to extend it to other processes on a simple probability, and without due experiment, is to promote a serious error. The distillation of corn spirits, which appears to have been first brought to high perfection in Germany, and in Holland, is now become an important assistance to our agriculture, particularly in the departments on the north and east of France. French Flanders, which, in this branch of industry, has inherited the long experience of the Dutch, contains several distilleries, in which they habitually draw off from 55 to 65 litres of spirits at 19° hydrometer from a quintal of rye flour. This assertion might be questioned by the distillers of the east, and the interior of the kingdom, if it were not confirmed by the experience of a great number of manufacturers. On the other hand, the former seldom obtain on an average, more than 40 to 44 litres of equal spirit from the same weight of flour; and several even do not average more than 30 to 35 litres. It appears to me that there is no manufacture which presents more varieties according to each individual establishment, than that of distilled spirits.

It would be important to know the precise cause of these differ-

ences, but practice has gone so far beyond theory in this kind of manufacture, that we are compelled to reason with great caution and restriction. When I was in the habit of visiting these works, being fresh from my chemical studies, I was surprised to find the distillers going to great expense to obtain a large supply of well-water for their fermentation, when the river which flowed before their doors would seem to offer an abundant supply without cost. On asking the reason of this preference, they were unable to give any other, than the remembrance of the great losses which they had incurred on taking to the use of river water, and which they had no desire to risk a second time. A more intelligent manufacturer told me that the best water for fermentation, was that which flowed over free-stone beds. This reminded me of having read that Higgins had recommended with success to the West India distillers, the use of lime to check the tendency to acid fermentation: and I doubt not that hard water, holding carbonate of lime in solution, by means of an excess of carbonic acid, has a similarly beneficial effect in preventing the tendency to acidity in the vats of the Flemish manufacturers, and thus in increasing the product of spirit; whilst, on the other hand, our own workmen can never obtain more than 40 to 44 litres, as long as they obstinately persist in the use of river water.

Description of a new Water Level. By Mr. W. K. Westly.

I beg leave to offer you the following description of a recent invention of mine, which you are at liberty to insert in your valuable publication, should you think it worthy of the honour.

I call it a water level, and am inclined to consider its use would be highly beneficial to the millwright, land surveyor, or hydraulic architect. It consists mainly in a series of flexible pipes, of a small bore, filled with water or other fluid, and made either entirely of leather, or of metal in short lengths connected by leather, or otherwise by water-tight metal joints, which are, at the same time, so contrived as to bend freely in every direction. When made of metal, which is the preferable way, each end of every length in the series is screwed with a similar thread, to fit all the other lengths; therefore, the instrument may be lengthened or shortened, as convenience requires, by the addition or subtraction of one or more lengths. It is completed by having a stop-cock placed in the last length of piping, at each extremity.

When the pipes are filled with water, and the extremities held upright, to prevent its escape, the stop-cocks at each end being both open, a small float, similar to those used in angling, is thrust into the apertures of the stop-cocks, to float on the water within the pipes. The stems or shanks of these floats, which are constantly vertical, are graduated into inches and decimal parts, rising from the surface of the water in which they float.

Such is the description of the instrument, and its use may be

learnt, by supposing that it is required to place a mill-shaft, or wheel, at one end of a building, exactly parallel to another wheel, or shaft, at the other end: let one extremity of the water level be opened, and a float placed in the pipe on the water; then bring the point of the stem to the centre of the shaft, and there fix it. Proceed with the other end of the water level, to the spot where the other shaft end, or wheel, is to be placed, and opening the other stop-cock without spilling any water, the stem of another float, placed in it, will indicate, with the utmost precision, the exact point where the second wheel, or shaft, is to be placed, in order to be parallel to the first.

Any one who has seen by what tedious methods millwrights in general obtain the levels of their work, and who is at all acquainted with the indispensable necessity of obtaining such levels, for the extensive and complicated trains of mill-gear in large factories, will at once perceive the utility of a water level.

Mill-shafts and wheels are, sometimes, placed in situations where, on account of walls and other obstacles, it is impossible to procure a level for them all without drawing a multitude of lines and cross lines, one from another, and each succeeding line liable to increase the error of the foregoing. Now, by the application of my instrument, all difficulty is at once done away, for the pipes may be carried underneath or round the wall, or other obstacle, and show the truth at once. Neither is distance any impediment to its action; for, supposing a sufficient length of pipes to be procured, and that the points chosen be high enough, a wheel in London might be placed level with a wheel in Leeds.

In land surveying, canal building, and fortification, I trust it will be found equally useful.

The instrument that I have used, has been made entirely of leather, with two copper pipes, one at each end, and the whole filled with water; but to those who would wish to have it in a more polished form, it might be suggested to have it made of brass pipes, one-eighth or three-sixteenths of an inch bore, and eight or nine inches long, with air-tight metal joints, and, instead of floats, to have two small pistons with graduated stems. In this construction, mercury, instead of water, might be used, and the whole contrived to fold up into a small compass, to be carried in the pocket. [*Repertory.*

On Refining Gold and Silver Articles. By M. Cadet de Gassicourt.

[From Annales Générales des Sciences Physiques.]

Some refiners of Paris have lately adopted a new method of *parting*, which offers great advantages. It is simple, easy, economical, and much less insalubrious than parting by nitric acid. It consists in six operations.

First operation.—Parting gold. On several furnaces a foot in diameter, vessels of platina are put, receiving each three kilo-

grammes (about six pounds,) of silver in grains. Into each vessel, which is of an oval shape, six kilogrammes of concentrated sulphuric acid are poured.

Each vessel is covered by a platina cone, having at its summit an opening of about a quarter of an inch, to allow the escape of the disengaged gaseous vapours. A platina pipe may be fitted to this orifice, to convey the gas into a chimney, or else a glass tube to convey it into a Woolf's apparatus.

These platina vessels, placed in a proper situation, are heated for fifteen hours. The disengagement of sulphurous gas, takes place only during two hours. Care is taken to establish a draft in the chimney, which determines the sulphurous gas to rise in the tube or pipe, and not to spread in the laboratory, which would incommode the workmen.

Second operation.—Take the sulphuric solution out of the vessels, and dilute it. When its specific gravity is from 15 to 20 degrees, put in plates of copper to throw down a precipitate.

Third operation.—The silver precipitated by the preceding operation, is melted in a crucible, and cast into ingots.

Fourth operation.—The saturated solution of copper, is evaporated to crystallization.

Fifth operation.—Wash the sulphate of copper with boiling water, separating thus the fine crystals from the small ones, which are redissolved and placed anew to crystallize.

Sixth operation.—The metal which, in the platina vessels, resisted the action of the sulphuric acid, is gold.

It is a well ascertained point in metallurgy, that worked standard silver contains one-thousandth of its weight of fine gold. Formerly this gold was lost. At present, 1000 kilogrammes of silver, give, by this process, one kilogramme of fine gold, worth nearly 3500 francs, or about 150*l.* Now, if it be considered how many thousands of kilogrammes of silver are annually cast in coin, in commerce and the arts, we shall be convinced of the immense advantages to the state, arising from the practice of the new methods, for which we are indebted to Messrs. Darcet and Lebel.

On the application of the Moiré Métallique (Metallic Watering) to Tin Foil. By M. Berry.

[From the Bulletin de la Société d'Encouragement.]

All leaves of beaten tin are susceptible of crystallizing, because the hammer has only broken, more or less, the tin crystals; and, without any other preparation, they give a larger or smaller grain.

It is not the same with laminated tin: the crystals are so exceedingly broken, that, on being taken out of the acid bath, the leaves of tin show only an oxydized surface, proving that the porosity is not the same as that of beaten leaves.

The means which I had employed for *moiring* tin-plates, became

impracticable on leaves of tin in complete fusion; thus there was no need of employing a blast of air, or water. Tin has so strong an attachment to the surface of iron, as to facilitate crystallization by the different means employed, and under different forms. It was requisite to make these leaves of tin undergo partial fusion, more or less extensive, but not general. I therefore took a leaf of brass, what is called in commerce, yellow tinsel (a very fine piece of woven wire would have produced the same effect:) after it was heated red hot, to anneal it, I nailed it on a frame, mounted on four feet, about eight inches long, to stand level on a table. I took a leaf of tin, which I extended upon the brass by rubbing it with a brush; afterwards I passed a small spirit-lamp under it, in different places, to fuse the tin, which produced me a very fine *moiré*. The ground was in grains, in a natural crystallization.

To produce grounds filled with flowers, I took round and flat irons; after having heated them red hot, and pressed them beneath the foil without friction, the contact melted the tin to the width of the iron. But care must be taken to withdraw the iron as soon as the tin appears to be melted, and not to replace it but at a certain distance from the part first brought into fusion, in order that the latter may have time to solidify, and not be confounded with the other. Afterward we may follow the same process between them.

By running leaves of tin upon fine cambric, or upon stone, different *moirés* may be formed in succession, at pleasure.

It now remains only to subject these leaves to the action of the acid, in order to develop the *moiré* produced by the heat. For this purpose, pass the composition over the foil with a sponge, or rather dip the foil into the liquid, and draw it out again, as soon as it has acquired its brilliancy; then rinse it in pure water, and wipe it dry. But in the latter case, care must be taken to coat the back of the foil with varnish, that the acid may not penetrate through it by acting on both sides.

The varnish I have used, is composed of Jews' pitch (*asphaltum*) dissolved in oil of turpentine.

The nitro-muriatic composition is made of two parts of nitric acid, and one part of muriatic acid, diluted with ten parts of water.*

* M. Herpin, of Metz, after having tried the vegetable acids without success, employed the mineral acids in various proportions, and found that nitro-muriatic acid gave the best results. If the tin is not varnished immediately after the operation of the acid mixture, it should be protected from oxydisement, by a pretty thick coat of a solution of gum arabic in water.

The success of the different *moirés* much depends on the alloy with which the iron plates are tinned. In several manufactories, bismuth, or antimony, is added to the tin, which contributes, it is believed, to these fine effects. The zinc, added by French manufacturers, is not advantageous. No result is obtained by operating on pure tin.

The *moiré* will bear the blow of a mallet, but not of a hammer.

The different colours are given by means of coloured varnishes.

Might not the tin foil moiring be applied, with good effect, to the front pipes of organs?

Preparation of a Red Colour, superior in lustre to Carmine. By M. Grotthuss.

[From les Bulletins de la Société d'Encouragement.]

Our painters have long employed carmine dissolved in ammonia, which at first renders it rather more of a violet colour; but the ammonia evaporating, it resumes its brilliancy. The advantage of the ammonia, is, that it separates the pure colouring matter of the vermilion, which is frequently mixed with carmine.

We believe that none of our painters have yet thought of afterwards precipitating the purple colouring matter from the ammoniacal solution. This induces us to publish the following process of M. Grotthuss.

Liquid ammonia, digested with carmine at an atmospheric heat of 60° Fahrenheit, seizes its colouring matter, dissolves it, and leaves only a residuum of an earthy appearance, and of a pale red. The author tried to separate this colouring matter from ammonia, which produced a most brilliant lustre, and succeeded perfectly with the help of concentrated acetic acid. He added the acid by degrees to the alkaline tincture, until the ammonia was completely saturated. It forms a precipitate of extraordinary lustre, upon which the eye can scarcely rest. The extreme fineness of this precipitate requires the addition of a little alcohol to the liquid, in order to diminish its density. This addition soon causes the colour to deposit, which then shows itself in all its brilliancy. The author decanted the colourless liquid, and after washing the deposit with alcohol, he dried it in a small capsule. This beautiful colour may be of great use to miniature painters.

On the use of Soap instead of Oil in setting Cutting Instruments on a Hone. By George Reveley, Esq.

[From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.]

I beg to communicate to the Society of Arts, for the benefit of the public, a new method of setting razors, by substituting soap instead of oil. Not having any oil to set my razor, it occurred to me to try the soap I was washing with, called palm-soap, and I found it so completely to answer my purpose, that I have constantly used it ever since, instead of oil, both for razors and penknives. It sets quicker, gives a good edge, and removes notches with great facility; it is a more cleanly material, oil being liable to drop on and soil any thing it comes in contact with: dust will frequently get into oil, which will spoil the edge, and in such case it must be changed. It is as cheap, or cheaper than oil; a small square of palm-soap costing only three-pence, which will last for a great length of time.

The operation is performed as follows: having first cleaned your hone with a sponge, soap, and water, wipe it dry; then dip the soap in some clean soft water, and wetting also the hone, rub the square of soap lightly over it, until the surface is thinly covered all over; then proceed to set in the usual way, keeping the soap sufficiently moist, and adding, from time to time, a little more soap and water if it should be necessary. Observe the soap is clean and free from dust, before you rub it on the hone; if it should not be so, it is easily washed clean; strap the razor, after setting, and also again when you put it by, and sponge the hone when you have done with it.

I herewith send certificates respecting my method of setting razors, which also includes workmen's tools; the fact thereby established of setting quicker, is important, as one-fourth in time gained by those who are employed in setting a considerable number of razors, &c. is an object both as to convenience and in saving expense; the excellent state in which it keeps the hone, is also an object, both in respect to cleanliness, and the advantage of its surface being kept in a better state for action than when oil is used. With respect to novelty, I only can say I never heard of any one having used it, or received any information from any one on the subject of setting with soap, previously to my making the communication to the Society, nor can I learn, on inquiry, that it is known to the public.

In addition to the preceding certificates, it is only necessary to state, that both Mr. West and Mr. Pepys made trial of Mr. Reveley's method, in presence of the committee, and to their entire satisfaction.

The saving, in point of time, observed by all who have made comparative trials of oil and soap, will, probably, be accounted for from the following considerations: if a blade of steel is drawn along a dry hone, certain parts of the hone will be found to be covered by a thin film of steel, abraded from the blade, and now adhering so firmly to the hone, as to prevent its action in the parts thus covered. Having removed the film of steel by means of a pummice-stone, and dropping a little oil on the surface of the hone, it will now be found that the abraded particles of steel are suspended in the oil, which thus becomes discoloured, while the whole surface of the hone continues to act on the edge, except where, from the irregularities of the stone, or the oblique position of the blade, a thin stratum of oil happens to be interposed. In this case, the tenacity of the oil preventing it from yielding readily to pressure, the blade is apt to slide a considerable distance before it again comes in contact with the surface of the stone. The tenacity of soap and water is by no means equal to that of oil, though capable of holding the abraded particles of steel suspended in it; hence the quantity of effective cutting surface of the hone, is increased.

ENGLISH PATENTS.

Specification of the patent granted to Samuel Kenrick, *Manufacturer, for an improved method of Tinning Cast-iron Vessels of Capacity.* Dated May 13, 1820.

My invention of an improved method of tinning cast-iron vessels of capacity, consists in a new method of suddenly cooling and setting tin, or other fusible metals mixed with tin, upon cast-iron vessels, by the application of a rapid current of air to the coating of tin, or other fusible metals mixed with tin, whilst in a state of fusion. I will first describe the operation of tinning the internal surfaces of cast-iron vessels, as it is commonly practised, in order to render the explanation of my improved method of cooling and setting the tin more clear and intelligible. The surface to which it is intended to apply the tin, being made smooth and even by grinding or turning, and the vessel being sufficiently heated, a proper quantity of melted tin is poured into it. Some sal-ammoniac melted upon the tin, is next rubbed hard upon the smooth surface of the vessel, and then by means of a piece of cork fixed on a light pair of tongs, a quantity of the melted tin is dashed or thrown upon the surface to which the sal-ammoniac was applied. The tin thus applied, attaches itself to the surface, the whole of which being covered, the superfluous tin is turned out. If the vessel was left to cool gradually, the tin would run down the sides, making a thicker coating towards the lower part; to prevent this, the vessel, with its mouth upwards, is suddenly plunged into water, which touches only the external surface, and by means of the sudden cold, the tin applied to the internal surface is set, and remains of a uniform thickness. This method of cooling and setting the tin succeeds for tinning the internal surfaces of vessels, and in cases where the water does not come into actual contact with the fluid tin upon the surface; but it cannot be successfully employed for tinning vessels on both surfaces at the same time, because it is ascertained that when the surface of a vessel is heated and covered with tin (in a state of fusion,) and of sufficient thickness to insure a good and even surface over the vessel, it will not admit of its being plunged into water to cool it suddenly, without materially displacing the tin from such parts as actually touch the water, leaving the tin in an uneven surface over the vessel, and nearly removing it, or driving it off in some parts. This renders the present mode of cooling and setting the tin by the application of water extremely objectionable. My invention enables me to avoid the inconvenience which has been mentioned, and to produce a smooth and uniform coating of tin over both the external and internal surfaces of cast-iron vessels. Having prepared the external and internal surfaces of the vessel by turning, grinding, or otherwise, so as to render them fit to receive the coatings of tin, I cover the internal surface with the melted tin by the method hereinbefore described; after the internal surface is so covered, I dip or immerse

the vessel in a quantity of melted tin, which is caused to adhere to the external surface by the employment of sal-ammoniac, in the manner heretofore used for the inside tinning. Then, by turning the vessel slowly round in the melted tin, it will gather a sufficient quantity upon both its surfaces to produce a good thick covering. When this is done, the vessel is quickly withdrawn from the melted tin, and according to my new method, exposed without loss of time to the action of a rapid current of air, which produces the effect of suddenly cooling and setting the tin upon both surfaces of the vessel; and by this method, the tin is not disturbed, but is left smooth and of a uniform thickness, as it was applied by the last operation. The current of air may be applied in any manner that may be found most convenient, and may be produced by a blowing machine, pair of bellows, or by *draft*, occasioned by means of a high chimney, or any other convenient way. I make claim generally to the employment of a rapid current of air, as a means of suddenly cooling and setting the tin in the operation of tinning cast-iron vessels, without confining myself to any peculiar or specific mode of producing or applying the current of air, but holding myself at liberty to produce the current of air in any convenient way, and to apply it to the external or internal surface of the vessel, or to both surfaces at the same time, in various ways, as occasionally may be found best.

To William Smith, *Merchant, for his improved method of manufacturing Cutlery, and other articles of Hardware; with or by means of Rollers.* Enrolled August, 1827.

The patentee says, that in order to understand the object of his improvement, it is necessary, in the first place, to describe the ordinary mode of making knives.

A sheet of steel being provided, the blades of knives are cut out of the sheet, and the backs, shoulders, and tangs, of wrought iron, are attached to the steel blades, by welding at the forge. The knife is then ground to the proper shape, and the blade polished and hardened.

Instead of this welding process, the patentee proposes to make the knives entirely of steel, and to form them by rolling in a heated state between massive rollers, the shoulders or boulsters, and the tangs for the handles being produced by suitable recesses in the peripheries of the rollers.

When the knife is to be made with what is called a scale tang, that is, a broad flat tang, to which the handle is to be attached in two pieces, riveted on the sides of the tang, the rollers are then only to have recesses cut in them, in a direction parallel to the axis for forming the boulster.

The plate of steel having been heated, is to be pressed between the two rollers, by which the blades and the parts for the scale tangs will be pressed out flat and thin, and those parts which pass between the grooves, or recess, will be left thick or protuberant, forming

the boulster for the shoulder of the blade. But if the tangs are round, in order to be fixed into handles, then it will be necessary also to form transverse grooves in the rollers, that is, at right angles to those which give shape to the boulsters, the transverse grooves corresponding in length, to the length of the intended tang.

When the plates of steel have been thus rolled, forming three or more knives in a breadth, the several knives are to be cut out by the ordinary mode of what is called slitting, and the blades and shoulders ground, hardened, and polished, in the usual way.

It is in the contemplation of the patentee, to make rasps for shoemakers, by similar means, that is, to roll plates of steel between eccentric rollers, which will form the rasps, tapering at the ends. After they have been so rolled, they may be roughed by the chisel in the usual manner, and afterwards hardened.

To William Dickinson, *Tin-plate Merchant, for his invention of an improved Buoyant Bed, or Mattress.* Enrolled February, 1828.

The principal object of the patentee, is, to construct a seaman's bed, or mattress, which, while it possesses all the advantages of elasticity common to other beds, or mattresses, shall also have the property of being buoyant in the water, and, therefore, may be resorted to as a means of saving the life of an individual in case of shipwreck.

A piece of ticking, cut to the dimensions of the intended bed, (say for one person,) is to be spread out flat and thin, and about four and a half pounds of horse hair carefully and evenly distributed over it; upon the horse hair, thin sheets of cork are to be laid in several thicknesses. About five pounds of cork, cut into sheets one-eighth of an inch thick, will be sufficient. Over the cork, another similar quantity of horse hair is to be distributed evenly, and then a piece of ticking, as before spread out, and covered over the whole. The edges, that is, the sides and ends of the bed, or mattress, are then to be closed by sewing, as usual, and the internal parts secured together by stitching through and through.

The bed, thus made, will possess all the elasticity necessary for sleeping on with comfort, and in the event of any accident at sea, the sailor, to whom the bed belongs, may strap it round his body and carry it about him, without inconvenience, until it may be necessary for him to save his life by swimming, when being thus prepared with a buoyant material, he may jump into the water, and will float without any personal exertion.

Beds of this description may be made with flocks, wool, or other materials, in place of horse hair, the thin sheets of cork applied to the purpose of forming the basis of the bed being the particular feature of novelty claimed. It is also to be observed, that beds,

pillows, seats, mattresses, and other cushions for ordinary purposes, may be made in the same way, and will possess the advantages of being very light and healthy to sit or recline upon.

To JOHN BROWN *and* WILLIAM DUDERIDGE CHAMPION, *Merchants and Copartners, for their having found out and discovered a certain composition, or substance, which may be manufactured or moulded, either into Bricks, or into Blocks of any form for Building, and also manufactured and moulded to, and made applicable for, all internal and external ornamental architectural purposes, and for various other purposes.* Enrolled July, 1827.

THE bricks and other articles proposed to be manufactured from this new compound, are intended to resemble those commonly called *Bath bricks.* The compound is to consist principally of a loamy deposit, formed in the river Parret, within a mile or two, both above and below the town of Bridgewater, which is to be mixed with a small quantity of clay and sand.

It is of very considerable importance to the perfecting of the articles intended to be made from this new compound, that the materials should be minutely broken, and blended together without lumps. It is, therefore, directed, that when the materials are ground in an ordinary pug-mill, that great care be taken to bring the whole under the operation of the knives or cutters, and it is suggested, that it would be adviseable to introduce other cutters into the mill, to work between the ordinary cutters.

After having been broken by the pug-mill, it is thought desirable to reduce the material still finer by the hand operation of grinding upon a stone with a mullar, and, indeed, to go through that operation two or three different times, until it is reduced to the finest condition.

The materials being then mixed up with such a quantity of water, as shall enable the mass to work freely, but stiff, the bricks or other articles to be made, may then be formed by moulding, as ordinary bricks are moulded; or any other forms, such as vases, cornices, blocks, and various architectural devices and ornaments, may be produced in the same way. It should, however, be observed, that if too much water be mixed with the materials, the articles will be subject to get out of form in drying. Pressure should be applied in moulding the material, and it is proposed by the patentees, to employ a stock for this purpose, but of what construction, is not shown.

After moulding, the articles are to be placed upon boards to dry in the air, under a shed, taking care that the drying is gradual, else they will be subject to crack, and when perfectly dry, they are to be baked as other articles of pottery, in a kiln or oven.

Some care is necessary in the selection of the clay, which is to be mixed with the other materials, as different kinds of clay will pro-

duce variations in the colour of the brick when baked, some being lighter, and others approaching to a dark red. The small quantity of salt which may be mixed with the loamy deposit, after the articles have been baked, will be so inconsiderable, as to be no detriment to the bricks, if employed for the purpose of building.

To Thomas Briedenbach, *Merchant, for his invention of certain improvements on Bedsteads, and in making, manufacturing, or forming, articles, to be applied to, or used in various ways with Bedsteads, from a material or materials hitherto unused for such purposes.* Enrolled February, 1828.

The improvement proposed, consists in the employment of woven metallic wire gauze, which is to be applied to various parts of a bedstead, that is, to form the sacking, the tester, and the back; and in place of hangings, or curtains, to enclose the sides and end.

The object proposed by the employment of woven metallic wire gauze, is, to prevent the harbouring of vermin in the bedstead, or its hangings; but it must be obvious that the invention is most particularly applicable to tropical climates, where a free circulation of air is desirable; and, at the same time, it is absolutely necessary to close every avenue by which moschetoes, or other insects, or snakes, could approach the persons sleeping.

In adopting this metallic gauze, in place of the sacking, tester, or head of the bedstead, the wire may be woven in a pannel, and its edges made fast to the posts and rails of the bedstead, whether of wood or metal; but in applying the metallic gauze to the hangings, or bed furniture, it is necessary to join the edges of the sheets of gauze together, by sewing them with wire, and thereby forming hinges.

The several pieces, or pannels of gauze, may, by these means, be made to fold together, and the hangings may, in that way, be opened or closed, and every aperture for the ingress of moschetoes or other insects, or reptiles, will, by those means, be rendered perfectly secure, and the persons sleeping, inaccessible.

To Charles Carpenter Bombas, Esq. *for his invention of improvements in the Propelling of Locomotive Carriages, Machines, Boats, and other Vessels.* Enrolled October, 1828.

These improvements in propelling locomotive carriages, boats, and other machinery, consist in the employment of a power to be derived from condensed air or gas, which is to be contained in a strong cylindrical reservoir, or vessel, with spherical ends, and discharged therefrom, through tubes, in small quantities, into an en-

gine, similarly constructed to a steam engine; and by the elastic force a piston is to be worked, which shall, by means of its rod, actuate a lever, or other mechanical contrivance connected to the wheels of the carriage, or boat, in any of the usual ways.

The dimensions of the cylindrical vessels intended to hold the condensed air or gas, are proposed to be from twelve to eighteen inches in diameter, and of any length which may be found convenient. Such vessels will not be too cumbersome for locomotive engines; and may be placed at certain stations on the road ready charged; at which stations the exhausted vessel may be removed, and a filled one be mounted on the carriage in its place.

The gas, or air, for supplying these reservoirs, may be introduced by a force pump, by mechanical means, or it may be generated chemically within the vessel. The state of condensation at which the gas, or air, is to be employed, may be from thirty to one hundred and fifty atmospheres, and it may be let out of the reservoir, through small pipes, to the working cylinder by valves, worked by the evolutions of the engine, by any of the modes or contrivances usually adapted to the steam engine.

No particular construction of carriage is proposed, nor of engine to drive it; but the compressed air is to be employed exactly in the same way as steam, and to work expansively, which is the subject matter of invention claimed. The same mode of employing condensed air to work an engine, is also applicable to propelling boats, and to every other purpose where mechanical force is required as a first mover. Of course, no particular construction of engine is proposed, nor are the modes of connecting the reservoir to the engine set out in any precise way.

To James Palmer, *Paper Maker, for his invention of certain improvements in the Moulds, Machinery, or Apparatus, for Making Paper.* Enrolled November, 1828.

The first object of the inventor applies to a novel mode of constructing the wire gauze cylinders, which receive the pulp in paper making machines; secondly, the wire gauze web, by which it is conducted to the felts; thirdly, the application of the same contrivances to making hand moulds.

In constructing the cylinders, a sufficient number of straight rods, or wires, all of the length of the intended cylinder, and as many, in number, as, when placed side by side, will extend over its periphery, are to be laid out flat, and then laced together by fine wire carried round each one, and through the whole range crosswise, in several places. When the rods are thus connected, forming a sheet, that sheet is to be bent round a cylinder of metal or wood, as a mandrel, and the two outer edges united. Rims, or wheels, are then to be fixed in the ends of the cylinders, with a shaft or axle through the centre, which will make the wire roller complete, and

fit for moulding paper in a paper making machine, such as Fourdrinier's.

Another method of constructing the wire rollers, is, by first winding a wire round a cylinder in a spiral direction, and then placing the straight rods upon the spiral wire, which are to be connected to it by soldering, and then, on withdrawing the mandrel, introducing the ends and axle, as described above.

A third method, is, by the employment of a great number of small pieces of flat metal bars of equal length, with small holes drilled near their ends, through which, rods of small wire are to be passed crosswise, so as to connect the pieces together in alternate positions, forming a sort of net or chain work. This, when so united, is to be bent round the mandrel, and formed into a cylindrical roller, with ends and an axle, as already explained. Ribs of metal are to be soldered on to the rollers at certain parts, for separating the paper into sheets, or a resinous material may be introduced into certain parts of the roller, for the same purpose.

The machine wire for conducting the paper from the moulding roller to the felts, is first described as formed of pieces connected together into a net or chain work, as explained above; secondly, by winding wire round a flat steel bar, and cutting the wire into links, which are to be joined and connected together by soldering, so as to form a net or chain work; thirdly, by winding wire round a steel bar into spiral coils, and then uniting or linking the bent parts of similar coils to these, which will likewise form a net or chain work.

Moulds, for hand making, may be constructed by wires or small pieces united together in a net or chain work, in the same way as above explained. Pieces of metal are proposed to be employed as "*safety engine plates,*" but in what way they are to be adapted to the engines, is not shown.

To Anthony Scott, *Earthenware Manufacturer, for his invention of an apparatus for Preventing the Boilers of Steam Engines and other similar Vessels of capacity, becoming foul, and for cleaning such Vessels, when they become foul.* Enrolled September, 1827.

The means proposed of preventing the accumulation and adhesion of sediment and foul matter on the bottoms and sides of boilers, is, by placing plates, slabs, or trays of metal, stone, clay, wood, or any other suitable material, near the bottom of the boilers; upon, or into which, the sediment from the boiling water will fall; and when it may be requisite to clean out the boiler, it will only be necessary to remove these plates, slabs, or trays, and to scrape out the sediment or incrustation therefrom, without touching the internal surface of the boiler itself.

These plates, slabs, or trays, are not to lay in close contact with the bottom of the boiler, but are to be raised upon feet or ledges, in

order that the water may pass freely over the bottom of the boiler, beneath the trays. By this arrangement, it is said that the water above the slabs or trays, will be very little disturbed by the boiling, and that the sediment will consequently descend by its gravity, without impediment.

To Benjamin Somers, M. D. *for his invention of certain improvements on Furnaces for Smelting different kinds of Metal Ores and Slaggs.* Enrolled October, 1827.

The patentee proposes to build his smelting furnaces of slaggs of ore, and by placing an intense fire within, to cause those slaggs partially to melt, and form an incrusted surface, which, after cooling, will be so hard and close, as to resist the future action of fire.

The description of the manner of constructing the furnace, as given in the specification, does not convey in very clear terms, the patentee's plan of operation. It seems that an iron pan is to form the bottom of the furnace, and to have holes perforated in it, which are to be tapped for drawing the fluid metal, when the furnace is in action; and slaggs of ore are to be built up round the pan, and closely beaten together. The sides are to be made inclining as usual. When this is done, a strong fire is to be raised within, and urged by blasts as usual, which will partially burn away the slaggs; to those fresh slaggs must be added, until the whole of the internal part of the furnace has become compact and firm.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS GRANTED IN FEBRUARY, 1829.

With Remarks and Exemplifications, by the Editor.

1. For a machine for shaving or *Dressing the inside of Staves for Casks,* called the Revolving Stave Dresser, for dressing the inside of Staves; Charles B. Goodrich, Rutland, Worcester county, Massachusetts, February 3.

A strong quadrangular frame is made, which is fixed horizontally. This frame is usually about ten feet long, five wide, and three high. A horizontal shaft, resting on gudgeons, on two pieces of timber, placed across the main frame, is made to revolve by means of a drum and strap. From one side of this shaft two arms extend out, and are framed into a block of wood, into which are affixed revolving cutters, bent at their ends, so as to act like a gouge. The arms are secured, by wedges, in mortices through the shaft, so that they may be shifted, to allow the cutters to stand at the distance of the semi-diameter of the intended barrel, from the centre of the

shaft, so that they may dress the inside of the stave to the proper curvature. Another arm extends out from the shaft, in a direction opposite to that of the cutters, for the purpose of carrying a weight which shall be an exact counterpoise to the cutter frame.

A sliding carriage is moved by a rack and pinion along one side of the main frame; the stave to be dressed is confined by dogs, on the inside of the carriage, and, as it is moved along, passes opposite to the cutters, which traverse the inside of it, from edge to edge, thus leaving it perfectly true, and of the proper curvature.

From a whorl on the main shaft, motion is communicated to the pinion which drives the carriage forward, and when the stave is dressed, this pinion is disengaged, the carriage drawn back by a weight passing over a pulley, and an undressed stave substituted for that which has been operated upon.

Instead of the arms which carry the cutters, it is intended sometimes to use wheels of different diameters, with cutters upon their edges. The patentee says, "I do not petition for a patent for all the details of the above described machine, but merely for the application of revolving cutters for dressing the inside of staves. A part of said cutters may be made flat, so as to leave the inside of the stave smooth."

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2. For a machine for shaving or *Dressing the outside of Staves for Casks*, called the Revolving Stave Dresser, for dressing the outside of staves; Charles B. Goodrich, Rutland, Worcester county, Massachusetts, February 4.

This machine is, in many of its parts, similar to the one last described, but is so constructed, as to cause the cutters to dress the stave convex on the outside, as the former left it concave on the inside. There is a horizontal shaft, fixed in collars or boxes, and turned by a drum. From the nature of the work to be performed, this part requires to be made of greater strength, than in the former machine, as the cutters stand at a considerable distance from their supports on the shaft. Suppose the curve to which the outside of the stave is to be cut, to be that of a circle two feet in diameter, there must be arms projecting at right angles from one end of the revolving shaft, to the outer ends of which other pieces must be framed at right angles, and parallel with the axis of the shaft, of a length greater than the full length of the stave to be dressed. The extreme ends of these are affixed to, and carry a rim of two feet, more or less, in diameter. Within this rim the cutters are placed, standing out towards its centre. Perhaps a more perfect idea of the structure may be formed, by supposing a barrel, or hogshead, affixed by the centre of one head to the shaft, like a chock to the mandrel of a lathe, the other head being out, and the cutters being placed within it. Instead of the barrel, the frame work forms a sort of cage, which operates in the same manner.

Within this rim, the carriage, with the stave, is made to slide, it being caused to advance and retreat, as in the first machine.

The patentee has evidently considered these two machines as per-

fectly distinct from each other, and has preferred the safe course of obtaining two patents; to us, however, it appears that in the present instance, they might have been included in one, as they are component parts of a system of machinery for dressing staves. The machinery for manufacturing blocks, consists of several distinct instruments for performing different operations, but, we believe, that they are all included under one patent.

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3. For an *Impelling Power for Mills* and Machinery; Benjamin S. Ridgeway, Charleston, South Carolina, February 6.

This is a horse mill of a peculiar construction, and, we believe, a novel one; we, however, are at a loss to discover its particular utility. A circular rail-way of wood, iron, or any other substance sufficiently hard, is constructed upon a solid foundation. The horse, or other animal, may walk either within or without this circle, the most convenient path being without the rail. A vertical shaft rises from the centre of the circle, like that of the ordinary horse mill, working upon a gudgeon below, and capable of giving motion to any machinery to which it may be geared: the novelty is, the mode in which motion is communicated to this shaft. Near its lower end is a bevelled cog-wheel, which is to be turned by a similar wheel on the end of a horizontal shaft, which is drawn round by the horse. Suppose the circle formed by the rail to be twenty feet in diameter, this horizontal shaft will be about ten feet in length. The horizontal shaft consists of a long frame, into the ends of which pass the gudgeons of a roller, which extends along it; on the inner end of the roller, there is a bevelled wheel taking into that on the vertical shaft, and on its outer end, a wheel, which is to roll round, by bearing upon the circular rail, upon which it rests. To the outer end of the frame is attached a swingle tree, by which the horse draws.

The circular rail, and the wheel which is to run upon it, it is said, may be either smooth or furnished with cogs; the latter, we apprehend, will always be found necessary, as otherwise the work to be performed, must offer a resistance inferior to that of the friction of the wheel upon the rail, or the wheel, instead of turning, would merely slide upon it, and might actually be drawn round, without communicating motion to the vertical shaft.

The patentee does not present us with any view of the advantages which he anticipates from the arrangement proposed, which to us appears to be not only more complex, but, in several particulars, inferior to the common horse mill.

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4. For an *improvement in Agriculture;* Peter Pardee, Trenton, Oneida county, New York, February 6.

The practical farmer will be able to judge of the value of this improvement, from the subjoined explanation, which contains the whole substance of the specification.

In the spring, as soon as the frost is out of the ground, it is to be broken up, and exposed to the air for about a month; and when

weeds begin to appear, the ploughing is to be repeated; this plan is to be followed throughout one season, the ground being again broken up in the fall, the more completely to expose it to the action of the frost.

The patentee says, that "This *invention* will apply with great profit, to most crops, except potatoes; the hoeing which they necessarily require, rendering the above process unnecessary."

"What I claim as my invention, or discovery, is, the fallowing of ground, with the common plough, for one season, without seeding, for the purpose of making more plentiful crops, with less labour for succeeding seasons, than in the common mode of cultivation."

That the above process will destroy the larger portion of weeds, is manifest; and, possibly, the ground may not, in the northern sections of our country, suffer much injury from being exposed, unshaded, and uncovered with verdure, to the direct action of the summer's sun; we know, however, that to the south, the general impression among agriculturists and planters, is, that the direct action of the sun upon the naked ground, is more exhausting than any crop that can be raised; if this be so, there would be more lost than gained by the foregoing procedure.

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5. For an improvement in the art of *Making White Paper*, from rags of cotton, linen, or silk, be their colours ever so various, and of extracting from all kinds of rags, all kinds of mineral colours, &c. &c.; John W. Cooper, Washington township, Franklin county, Pennsylvania, February 7.

Should this patent justify the claims which its title presents to us, it will, indeed, be a valuable improvement in the arts. The course we have adopted forbids our publishing the process, which is the same as that for which a patent was granted to Mrs. Henrietta Cooper, on the 12th of November last, for whitening straw, &c. So far as our knowledge enables us to judge of a chemical process, we are very apprehensive, that *all kinds of mineral colours* will not yield to the treatment proposed; and we believe also, that we know of some vegetable colours, which would prove rather refractory.

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6. For a Machine for *Planing, Matching, or Grooving Boards;* Caleb Taylor, Collins, Erie county, New York, February 7.

A long frame is made, with strong parallel timbers, passing from end to end, and dressed with great truth. The boards to be planed are placed upon carriages, which slide between these timbers. A carriage consists of a single piece of timber, of sufficient width to receive the board; it may be about 20 feet long, and five or six inches thick; on the under side of the carriage, there are cogs to be acted upon, by a spur wheel, in the manner of the carriage of a saw mill. The plane stock is to be fixed in its place, by wedges or screws; it is to be from one to two feet wide, and four or five feet long; the plane

irons are to be the whole width of the board to be planed; three, four, or five irons are to stand one behind the other, being set so that each successive iron shall cut the thickness of a shaving deeper than the preceding. The irons are to be fixed in the stock, in the usual way; the board, or plank, is held in its place by hooks, with teeth, resembling those in common use.

There is to be a second carriage, for the purpose of jointing, grooving, or matching, the edges of flooring plank; the jointers, with their successive irons, are placed so as to operate on each edge of the plank at the same time, whilst the match planes, with a sufficient number of irons to cut the tongue and groove to the proper depth, succeed to the jointers.

For the lighter kinds of work, the machine is to be moved by hand; but water, or other power, is in general to be employed.

There are some patented machines in operation, and which have been very successfully used, for making sash, and other small work, which, in their general operation, resemble the foregoing; but, although we may cut a twig, by a single stroke of a penknife, we should be foiled, in the attempt to fell the sturdy oak, by a single blow of an axe, however large we made it, and whatever power we applied; and we think that, in like manner, the patentee must fail in using four or five plane irons, from a foot to eighteen inches wide, each of which is to take a shaving, at the same time, from the same plank. The power to be applied must be immensely great, and were the frame of iron, instead of wood, its spring would be likely to defeat the hopes of the projector, were this the only difficulty; but these, upon the plan proposed, appear to us to be numerous and insurmountable, as they arise not from the structure of the machine merely, but from the nature of the stuff which is to be acted upon. There are but few boards, which do not require some *coaxing*, when planed by hand, and these, we apprehend, would exhibit strong evidences of their perverseness, if forcibly assailed in the way proposed by the patentee.

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7. For an improvement in the *Groove Plane;* Jacob Longanecker, and Charles Myers, Lancaster, Pennsylvania, February 7.

The specification is in very few words, as follows;—"The improvements on the groove plane, which we claim as inventors, consists in the following; two separate bits, or irons, instead of one with a groove in it. These two bits, or irons, are regulated in the plane by a small iron screw, in each end thereof, confining them to a width necessary to make a tongue of the size wanted; by this improvement, the side of each bit or iron, towards the other, can be ground fair, and always kept full at the corners, so that the plane works with the same ease at all times as when new."

We think this a real improvement in the groove, or rather in the *tongue* plane. The notched irons, as they wear, become wider, so as to leave the tongue too large; in the improved plane, the size of

the tongue can be regulated with precision. The two irons are confined by one wedge.

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8. For a *Double Axle-tree Safety Carriage;* Edward G. Fitch, Blakely, Baldwin county, Alabama, February 7.

The carriage represented in the drawing, deposited by the patentee, has a body like that of an ordinary wagon, but the main part of the body stands below the axles, which pass through slots in the sides, just below the upper frame.

The wheels are fast to the axles, each axle reaching nearly to the centre of the carriage, and turning in boxes, fastened to a bar of wood, which extends from one side of the carriage to the other. The four wheels, therefore, have four axles. The body of the carriage is suspended to the middle of the connecting bars, in a way not explained, but so that the bars may swivel, to the extent of the slots in the sides, for the purpose of turning the carriage. Both pair of wheels are fixed in the same manner, and are equal in size.

In order to cause the hind and fore wheels both to aid in the turning of the carriage, the connecting bars are made to operate upon each other, so that the pole by which the carriage is drawn, shall, when it acts upon the fore wheels in turning, produce a corresponding effect upon the hind ones. This is accomplished by framing two bars of wood, one to each connecting bar, so as to meet each other, under the body of the wagon. The ends of these are furnished with toothed segments, crossing chains, or some similar contrivance, producing an effect like that of the beds of the two axles as described in the specification of Howard's rail-way carriage, in the January number of this Journal. The patentee observes, that "the fore connecting bar turned one way, will cause the hind connecting bar to turn the other, and will thus cause the carriage to turn in a less space, than it would if but one of the connecting bars turned. The advantage of having the fore and hind connecting bars turn, is, that the wheels may be made all of a size, and large, and have the body of the carriage suspended under the axle, from a frame passing over the connecting bars, and resting on their centres."

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9. For a 'Premium Rail-way, *Cooking Stove,*' which combines greater utility, economy, and portability, than any stove heretofore invented, &c. &c.; Peregrine Williamson, Philadelphia, February 16.

[We will hereafter publish the specification of this patent, with an engraving of the stove.]

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10. For an improvement in the art of *Alphabetical Writing,* called *Lektography;* J. B. Manning, Gloucester, Essex county, Massachusetts, February 16.

The patentee commences by stating, that "The object of this improvement is to supply what is wanting in the analysis, classification,

and representation of the elementary sounds of English pronunciation, for pronouncing dictionaries, and for all the uses to which an equivalent, or uniform orthography may be applied."

The exemplification of the patentee's method of attaining this end, occupies sixteen well filled pages. The author has evidently thought deeply upon the subject, has formed a well digested system, so far as his own mind is concerned, and has expressed his views with much clearness. These are our impressions, from that hasty view which we have necessarily taken; but we do not pretend to have mastered in an hour, what has been, to the writer, the study of many years, especially, as we must confess, that if we have any fort it is not philology.

The author is of opinion, that the government might advantageously apply his scheme of notation, to the illustration of the Indian languages, and thus promote the beneficent objects which it has in view, in regard to the aborigines of our country. Had he studied as closely, the nature and operation of that complex piece of machinery, called government, as he has his own particular system, his hopes of adding to it a new wheel, pinion, or lever, would have been faint. We do not think that he is likely to make this his *punctum saliens,* in giving life to his new system.

With or without a patent, there is scarcely any task, (perpetual motion excepted,) more difficult, than to innovate on any of the established forms of language. In the present instance, we see no hope for the author, unless he will write a dictionary, using his own notation instead of that of Walker, and make the work as popular as that of this celebrated orthoepist.

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11. For fabricating *Tow Lines for Canal Boats,* by substituting lines made from raw hides, for chains, or cords, of hemp or flax; James Sandford, Weston, Fairfield county, Connecticut, February 16.

Ropes made of the ordinary materials, it is stated, are soon destroyed by their friction against the sides of the canal. Lines of raw hide, may be made by cutting the skin into strips of a proper width, looping them together at their ends, and twisting them whilst in a wet and pliable state. Lines thus formed, costing from ten to fifteen dollars, it is averred, will serve a boat through one season, which would require from twelve to fifteen ordinary ropes.

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12. For an improved mode of making *Brooms, or Brushes,* whether of Corn, Splints, Bristles, or any other material; David Wooster, China, Genesee county, New York, February 16.

The stock of the broom is to be divided into two parts; to the upper portion, the handle is to be attached; and the lower is to receive the bristles, &c. So far it would resemble a scrubbing brush fastened to a block and handle; but in this the lower part of the stock is to be fastened to the upper, by screws and nuts, attached to an iron strap. The broom handle is not to pass directly into the upper block, but

has a flat steel spring attached to its lower end, and connecting it with the upper block.

"The benefits resulting from this invention, are, durability, economy, *simplicity*, and ease in using the brooms or brushes, arising from the elasticity occasioned by the spring." So says the patentee.

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13. For an improvement in the mode of *Manufacturing Wool, or other fibrous Material*, being a method in which the strans of wool, flax, cotton, hemp, or other fibrous material, in the SECOND carding operation, therein described, are fed to the card, and conducted so as to cause the sliver, slubbing, or roping, to be even, and of a uniform size, when taken or delivered from the delivering cylinder, or doffer card; John Goulding, Dedham, Massachusetts, February 16.

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14. For an improvement in the mode of *Manufacturing Wool, or other fibrous Material*, being a method in which the strans of wool, flax, cotton, hemp, or other fibrous material, in the THIRD carding operation, therein described, are fed to the card, and conducted so as to cause the sliver, slubbing, or roping, to be even and of a uniform size, when taken or delivered from the delivering cylinder, or doffer card; John Goulding, Dedham, Massachusetts, February 16, 1829.

The two preceding titles are part of a series of patents, which have been granted to Mr. Goulding, for his improvements in spinning; four, we believe, had been previously issued, and he intends to apply for some others, now in progress; at present we shall pass them over without further notice, as an adequate idea of their nature could not be conveyed without several engravings.

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15. For improvements in the machines called *Jacks, or Jack Screws*, used for stowing goods in ships' holds, raising heavy weights, &c.; Thomas Evans, New York, February 16.

The common Jack, operates by means of a rack and pinion; the improved Jack, which the inventor calls 'Evans's improved American Jack Screw,' consists, mainly, of a screw and nut, and two bevelled wheels, and appears to us to be a manifest improvement. The stock consists of two pieces of timber, divided longitudinally, and bolted together; it is usually made three feet eight inches long, ten inches wide, and five thick. An iron screw, three feet six inches long, is contained within it, and forms the dagger of the Jack. A nut, or female screw, is inserted towards the upper part of the stock, which is there strengthened and secured by iron boxes, or plates. The nut has a bevelled wheel cast upon it, which is turned by a bevelled pinion, fitted into the iron box; the squared end of the axis of this pinion, receives the lever which is to raise the screw. The male screw is kept from turning by a bolt, or pin, passed through and projecting

from its lower end, and sliding in longitudinal grooves in the stock. The patentee says, "What I claim as new, and my invention, in the above described machine, is the application of bevelled wheels to cause the female screw to rotate; and likewise the method of preventing the male screw, or dagger, from turning, when in operation, by means of a key sliding in the groove on each side of the hole in the stock, as above described."

A screw jack is described in Nicholson's Operative Mechanic, but certainly very inferior to the foregoing.

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16. For a *Swing Staging, to enable workmen to ascend and descend on the sides of buildings,* for the purposes of building, clapboarding, painting, repairing, &c.; Elijah Drury, Worthington, Hampshire county, Massachusetts, February 16.

A platform or staging is prepared, of sufficient length and width for the workmen, and materials; from cross timbers under the ends of the platform, rise two uprights, and through the upper ends of these, pass the gudgeons of a roller, extending the whole length of the platform, and above the heads of the workmen. The platform, or staging, is suspended by ropes, fastened above to the upper part of the building, and attached below to the roller, round which it may be wound, and the staging consequently raised or lowered. To effect this, a toothed wheel is placed on one end of the roller, which becomes its axis, and below this there is a pinion, which a workman upon the platform may turn, by means of a crank; one end of the gudgeon of the pinion passing into the upright at the end of the platform, and the other through a standard, framed into the timber for that purpose. Rollers are fixed to the side of the platform, to cause it to ascend, and descend, without catching upon small projections from the wall.

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17. For an improved *Fanning Mill;* Justus Frarey, Southampton, Hampshire county, Massachusetts, February 17.

The nature of the improvement, is briefly and clearly stated in the specification, as follows: "The particular parts that I claim as my invention, and improvement upon the old fanning mill, are the following: The wind wheel turns in an opposite direction to the wind wheels in the old fanning mills, and the aperture through which its wind passes out of the shell of the wind wheel, is near the top of the shell; while in the old mills the aperture is near the bottom, or extends from the top to the bottom of the shell. By having the aperture near the top, the sieves through which the grain passes, are brought much nearer the wind wheel, and the whole current of air put in motion by the wind wheel acts directly upon the grain, whilst in the others, a small portion only, passes directly upon the grain, so that much less wind is required in this, than in the old fanning mills; beside which, the machine is brought into a much smaller compass."

18. For an *Economical Baker*, for all sorts of culinary baking; Philip Wilcox, Springfield, Hampden county, Massachusetts, February 18.

Patents for cooking stoves and ovens, are nearly as numerous as those for washing machines, and in a great number of instances, the family resemblances of the former are nearly as striking as those of the latter, and the patentees themselves, are puzzled to tell what is their invention, excepting they apply the term to a mere contortion.

The oven for which the present patent is taken, is to be composed of cast or sheet iron, forming a square box, with the exception of the top, which is arched. From front to back of this passes the oven, surrounded at the sides by the box, and closed, as it ought to be, by a door in front. Below the oven is an iron drawer with a grate to contain charcoal, or other fuel, with openings to admit air to keep up the combustion. There are certain other appendages, such as slides to open and close to admit air to enter, and to allow it, and steam, to escape; and the whole is surmounted by a pipe, or chimney, that the smoke &c. may make their exit. The specification states, that the patentee "claims as new, and as his own original invention, every part of the above described structure, which is essential and material to effect the purpose for which it is intended."

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19. For an improved *Circular Revolving Saw;* Tyler Howe, Spencer, Worcester county, Massachusetts, February 19.

This improvement in the circular saw, consists in the insertion of four teeth, more or less, which shall have greater thickness, and be rather shorter, than the other teeth, so as to answer the ordinary purpose of setting the teeth, but to operate to greater advantage, as they are so formed and filed as to cut laterally, and render the stuff sawed, remarkably smooth upon its surface. The patentee claims nothing more than the improvement above described.

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20. For a machine for *Sharpening Carving Knives,* and other tools that require a rough edge; denominated the "Compound Guard, and Knife Sharpener;" Walter Hunt, New York, February 19.

This sharpener consists of two small wheels of hard steel, turning upon centre pins, and so placed that their peripheries intersect each other. The knife to be sharpened is drawn across between these two disks, by which means it readily obtains a fine cutting edge. We have one of them in use, and find it to answer the intention perfectly. A machine somewhat similar has been patented in England, and many of them imported into this country. These consisted of two long rollers or cylinders of steel, so turned in ridges and hollows, as to allow the ridges reciprocally to interlock, or intersect; between, and along these, the knife is drawn.

In most instances, the two rollers used by Mr. Hunt, are fixed within cheeks formed in the guard of the carving fork. The claim is in the following words:—"What I particularly claim in this im-

provement, as my invention or discovery, is the form of the sharpeners for the aforesaid purpose, being thin circular plates, requiring little space or room, easy to be repaired, and trifling in expense. And, I still further claim as my right of invention, the fixing, connecting, or attaching the sharpeners to the carving fork, or any appendage thereof, either for the double purpose of guard and sharpener, or for the single purpose of a sharpener."

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21. For an improvement in the *Machine for Pressing, and Raising Weights;* Mayer Cummings, Mayville, Chautauque county, New York, February 19.

This is simply a rack and pinion press; the only difference between it and those ordinarily used, being the formation of teeth on both sides of the rack, and the use of two pinions, and two cranks, or levers, to work it; by which means the patentee believes that much friction is prevented, and consequently more effect produced by the same power.

Specifications of American Patents.

Specification of a patent for improvements in communicating Power and Motion, by means of Metallic Bands, and their application to various purposes, and particularly to a Rotary Pump. Granted to Joseph Eve, *of Augusta, Georgia, May* 1, 1828.

My said improvements consist of the following particulars: *First*, I cause bands to be made of thin plates of any metal, alloy, or composition of metal, that may best suit the particular purpose for which they are intended; which bands I use in almost every place where leather or cloth bands, or cords, or catgut, or chains, have been heretofore used for impelling machinery by means of pullies.

Second.—My second improvement consists in the application of metallic bands, as above specified, to elevators on the plan of Evans, or others, or to chain pumps in place of chains, to turning lathes, many kinds of light machinery used in the manufacturing of cotton, &c. and more particularly to a kind of rotary pump or water elevator hereafter to be described.

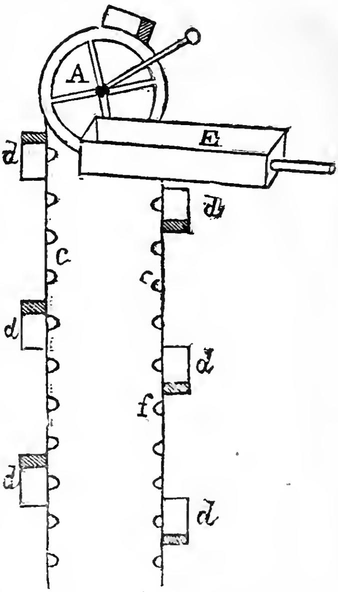
My first particular is dependant on the following quality of metal in common with many other materials, which, though well known to every person, has never been considered, or improved, or made use of, for any mechanical purpose, to my knowledge, in the manner and for the uses I am about to mention and explain.

All metals, as well as their compounds and alloys, are elastic to a certain degree; even lead and copper; which elasticity may be improved by tempering or hammering, or by pressure between rollers: but this elasticity has its limits, if carried beyond which, some metals will break asunder, as steel, and some will take a *set*, so to

express it, as soft iron, copper, &c. But within the limits of their elasticity, they are capable of being bent backwards and forwards for ever, to speak in common language, without change or injury. You may over-bend a steel bow, and break it; but if not bent beyond its proof, it will never break, however constant or long it is used. In like manner, a sheet of tin (tinned iron) may be wrapped round a cylinder of a certain diameter, and will become straight again when let go; but if you diminish the diameter of the cylinder beyond a certain degree, it will take a *set* if bent round it, and require straightening every time you thus apply it; and if wrapped round such a cylinder again and again continually, and straightened as often, there is no doubt but that in time it would break asunder.

It follows, from the above premises, that if thin plates of metal be applied as leather bands are, so that the bend of the segment they touch be not too great for their elasticity, they will not break, or undergo any change in their structure, though the pullies be made to revolve ever so long or so fast, or whatever force be applied within the limits of their strength, even when straight. Here then we have all the desiderata of a band, and, probably, the best means yet known, of communicating power and motion to a great distance; one of the greatest difficulties in practical mechanics. But metallic bands applied over the smooth surface of pullies, would yield or slip if considerable resistance were opposed to them, and this is a fault they have when simply applied, in common with leather and other bands, but, perhaps, in a greater degree, from their being smoother; but they admit of a remedy that other bands do not, which is, that of having cogs soldered on their under surface, which I have done very successfully, working in grooves on the surface of the pullies at such distances, that about six shall be equally divided on the periphery of the pulley; or there may be metal points projecting from the surface of the pulley, and corresponding holes made in the band; these methods, and there may be others, effectually prevent the band from slipping, under any resistance, and are analagous to hooks and other contrivances resorted to, to prevent chains from slipping when used in chain pumps and for other purposes. Metallic bands may be made of tinned iron (common tin plates,) or tinned copper, or iron, or copper plates, &c. untinned; but sheets of steel are much better than any other material; having double the strength and elasticity of any other metal, they may be made so thin as to be applied to the smallest pullies. Endless saws have been applied this way over pullies made so large as not to bend them beyond the limits of their elasticity; but here the application is not that of a band to communicate power and different degrees of velocity, but as a means to give rotary motion to saws.

My second particular consists in the mode of applying metallic bands to rotary pumps or water elevators. A reference to the annexed diagram, will best explain my mode of doing it.



A, represents a pulley of 18 inches diameter, with the axle and handle, or winch. The centre of this pulley is placed about three feet above the platform of the well, or surface of the ground. It has high edges to prevent the bands from slipping off. There is a pulley at the bottom of the well, like the above in every respect, except that it has no handle. It serves to guide the band, and is placed within a few inches of the bottom of the well. *c*, *c*, a band of sheet tin $3\frac{1}{4}$ inches wide; the length of course depends on the depth of the well, and, it necessarily follows, that if the same number of buckets are used, they will be farther from, or nearer to, each other, according to the depth of the well. *d*, *d*, *d*, *d*, &c. tin buckets made square, containing a quart each. They are of the same width as the band, and attached to it by 2 knees, that pass under the band and up the side of the buckets. There are 24 buckets, placed at equal distances, which number of buckets may be used for any pump for domestic purposes, be the well of greater or less depth. This will equalize the power to raise water from any depth, by making the water delivered in a given time in the inverse ratio of the depth of the well; that is, but $\frac{1}{4}$ of the water will be delivered by the same power in the same time from a well of 100 feet deep, that will be raised from a well of 25 feet by the same power, in the same time. E, is the spout, that receives the water; it is placed on the side of the pulley at right angles with its axis. *f*, &c. the cogs, continued all round the inner surface of the band, at about 9 inches apart, or exactly $\frac{1}{6}$ of the periphery of the pullies; they are placed in the middle, and are half its width. They are made of sheet tin soldered on; as their office is only to keep the bands from slipping, they will never wear. They fall into grooves made at corresponding distances on the periphery of the pulley.

I made my experimental pump to the above plan, and of the dimensions and materials there specified, and it answers very well. The well was 25 feet deep. It delivers, when the pulley is made to revolve 60 times a minute, 30 gallons. A boy or girl 10 or 12 years old, can work it with tolerable ease. I do not confine myself to the particular mode of making these machines described above, or to any dimensions. The materials also might be varied; leather bands, &c. and wooden buckets, &c. might be substituted. Though I am of opinion that tinned copper plates would answer better, as being more durable than any other material. The pulley beam may

be made of cast-iron, without arms or axles. A mere ring with flanches to keep the band from coming off, or an immoveable circular guide, may be substituted in the manner of the modern chain pumps which have no wheel at the bottom of the well. These pumps are peculiarly adapted to deep wells, or shafts of mines several hundred feet deep. JOSEPH EVE.

Specification of a patent for Terra-Metallic Teeth, called also Porcelain Teeth, which are so made as to admit of soldering to them a plate of silver, gold, or platina. Granted to ANTHONY PLANTOU, *Surgeon Dentist, Philadelphia, Penn. April* 5, 1828.

TILL this important improvement, one or two small pieces of platina, were inserted into the teeth at the time of their fabrication, which much weakened the teeth, and very often caused them to split in the baking, or in the soldering, and more often came out or separated itself from the teeth when in use; all these great disadvantages are obviated by not inserting any platina into the teeth at the time of their fabrication, and instead of it, to make, with a small wire, a hole through the teeth, which, after the baking, is stopped or filled up with silver, gold, or platina wire, and gold solder melted on both extremities of it; this adds much to the strength of the teeth, and they are lighter by not using platina. Teeth so made, and of a good material, never will break, or separate themselves from the wire, nor the wire from the plate; which brings the art of the dentist to its perfection, for artificial teeth.

In order to secure to myself the advantages which are to result to society from this improvement, and to prevent the common practice of infringing patent rights, I also specify that porcelain teeth may be well secured to a plate, if the small hole is made in the teeth, without passing entirely through them, and after the baking, a wire of silver, or gold, is introduced into the hole, and gold solder melted into it, which makes a perfect hold, if at the time of the fabrication of the teeth, the said holds are made a little larger at the bottom than at the top; this mode would be still neater, but, perhaps, not so secure as the other.

I must say that these important improvements have been suggested to me by necessity, which is truly the mother of invention; platina being at this time so dear, so scarce, and, in fact, not being able to obtain any, I have made experiments, and have formed teeth without it, and soldered them so well to a gold plate, that I have no doubt experience will soon prove that this new mode has a great superiority over the ancient. A. PLANTOU.

Specification of a patent for an improvement in Locomotive Engines, or Carriages, Propelled by Steam, on Rail, or other Roads, denominated the "Improved Locomotive Carriage." Granted to William Howard, Esq. *United States Civil Engineer, Baltimore, Maryland, December* 10, 1828.

(WITH TWO COPPER-PLATES.)

To render the locomotive engine, or carriage, capable of travelling on a curved road, without a much greater degree of friction than is encountered by it when moving on a straight road, two things are necessary.

1st. That the axletrees be capable of adapting themselves to the curve of the road, so that a perpendicular plane drawn through the centre of the axle, will be normal to the curve.

2nd. That the wheel moving on the outer rail, or larger circle, shall be capable of moving faster than the opposite one, without derangement to the machinery.

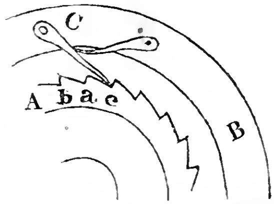
These two ends I accomplish as follows, and claim the same as my invention.

1. The arrangement for joining the axles is thus. The usual beam fastened by jaws to the axles, is divided in the centre, and a tooth and socket permits one end to play in the other. This contrivance, as shown in my improved rail-way carriage, obliges the hind wheels to follow in the track of the fore ones. Besides this, there is a beam extending from one axle to the other, and traversing on the centre of each, round a strong bolt. To this beam, the boilers with the cylinders are attached. The boiler, indeed, may be made to answer the purpose of this beam, by placing it upon beds, beneath which the axles move horizontally around centre bolts. At each side of the boiler, and attached to the axles, and moving with them, are perpendicular supports or guides, with openings for the vertical motion of the ends of the shackle bar of the piston rod; each pair of supports, or guides, being connected at the top by an iron bar, in the centre of which is a bolt connecting it with an iron frame passing lengthwise from each extremity of the boiler to which it is fastened, and which keeps the supports, or guides, in their vertical position. This last bolt is directly over the bolt of the wagon bed, as well as over the centre of the cylinders, so that when the axle moves horizontally around the wagon bed bolt, the supports, or guides, moving with it, make the bar connecting the supports, and which is always parallel with the axle, revolve round the bolt in the frame above the boiler and cylinders, which are stationary; and the shackle bar moving at the same time horizontally, with its guides, around the head of the piston rod, which is constructed to allow of such motion, the horizontal motion of the axle does not interfere with the working of the engine. To preserve a uniformity of motion, a balance beam, supported from the boiler bed, is connected with the shackle bar of each piston rod, so as to allow of its vertical

motion, and, at the same time, the horizontal motion occasioned by an alteration of the direction of the wheels. In this I claim as original, the principle of making the shackle bar traverse round the head of the piston rod, and the means by which this is accomplished.

2. I make the outer wheel go faster than the inner, when necessary, in this way. The axle revolves as usual in rail-way wagons, and the carriage wheels revolve likewise upon the axle; but at the extremity of the axle, there is a ratchet wheel fastened, to the rim of which the connecting rod from the shackle bar is fastened, instead of to the carriage wheel, as is customary. From the rim of the carriage wheel, there is a catch and spring striking the teeth of the ratchet wheel, and uniting the two as one wheel, except when it becomes necessary that one carriage wheel should, in describing a large circle, go faster than the other, or, in other words, faster than the axle and ratchet wheel. The carriage wheel then moving faster than the ratchet wheel fastened to the axle, the spring and catch on the rim slide over the teeth of the ratchet wheel, until a straight motion makes the catch hold the teeth again, or a reversed curve causes the opposite wheel to perform the same operation.

Here B is the carriage wheel, and A the ratchet wheel. The wheels going in the direction B, C, the catch C makes the two wheels but as one: but when B goes faster than A, or than the opposite wheel, then C slides from c to a, and b, &c. &c., where it is again held stationary on resuming a straight course, or a reversed curve. So that the engine, notwithstanding the altered velocity of the wheels, still performs its motion with regularity; no change ever taking place in the velocity of the ratchet wheels. The whole of this invention I claim as new.



WILLIAM HOWARD.

DESCRIPTION OF THE DRAWINGS OF THE IMPROVED LOCOMOTIVE ENGINE OR CARRIAGE.

In Fig. 1 and 2, Plate VII., and Fig. 1, Plate VIII., the same letters refer to the same parts.

A, the boiler resting on its bed H.

B, B, the cylinders.

C, C, the connecting rods between the shackle bars and the ratchet wheels.

D, D, the supports or guides for the shackle bars.

E, E, the iron frame attached to the boiler, and united to the guides by the bolts S, S.

F, F, the axis of the balance beam.

G, G, the axles.

H, the boiler beds.

I, furnace door.

K, the carriage wheels.

L, L, the ratchet wheels.
M, the bolt uniting the boiler bed and the axles.
O, O, the shackle bars.
P, the junction of the balance beam with the piston rod.
S, S, bolts uniting the supports or guides with the frame E, E.
W, the tooth and socket of the beam uniting the axles.
Y, and a, the catch and spring.
Z, the balance beam.
Plate VIII., Fig. 2.
A, the axle.
B, the support or guides.
C, the shoulder for the carriage wheel.
D, the octagon for the ratchet wheel.
Fig. 3.
A, the carriage wheel.
B, the ratchet wheel.
C, the connecting rod.
D, the catch.
E, the spring.
a, b, c, d, e, the teeth of ratchet wheel.

In these drawings, friction wheels and the details of steam machinery have been omitted, for the purpose of making the drawings easier to be understood.

Fig. 4, needs no explanation.

Specification of a patent for a machine called Brown's Reel for Tanning, or Handling, Hides, Skins, &c. by which a great part of the labour is saved, as it obviates the necessity of taking them out of the vat, to change their position. Granted to William Brown, *Tanner, Kensington, Philadelphia county, Pennsylvania, April 17th,* 1828.

This machine is a reel or cylinder, of dimensions suited to the vat in which it is to be used; it consists of two or more cylindrical wheels, either solid or otherwise, placed at certain distances apart, and properly framed together, with a shaft, or axis, passing through their centres, having gudgeons, on the extreme ends, to rotate upon; they are also connected together by four, or more, laths, extending nearly the whole length of the axis; which, when attached to the outer surface of the wheels, may properly be called the reel. At the head are fixed four handles to turn the reel by, or it may be turned by other means; it is to be supported by a slide at each end of the axis or shaft, which works in the lower end of the slides, and can be lowered and raised, at the pleasure of the workmen, and supported by pins passing through the slides into cleats on the surface of the vat; on the outer surface of each wheel, are short thongs of leather, having both their ends fastened by pinning them into holes about one inch, more

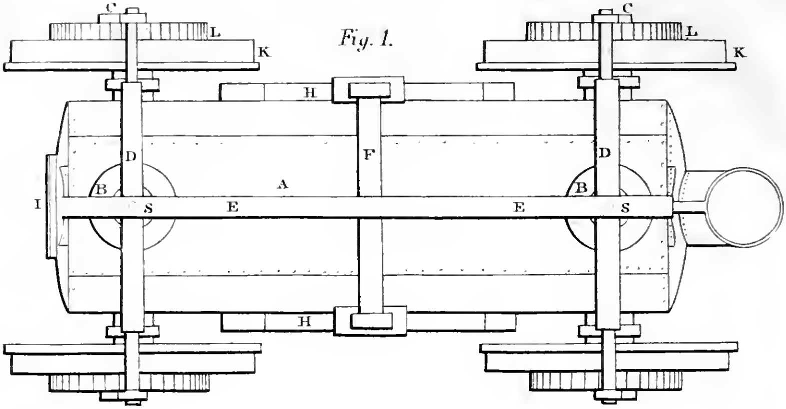


Fig. 1.

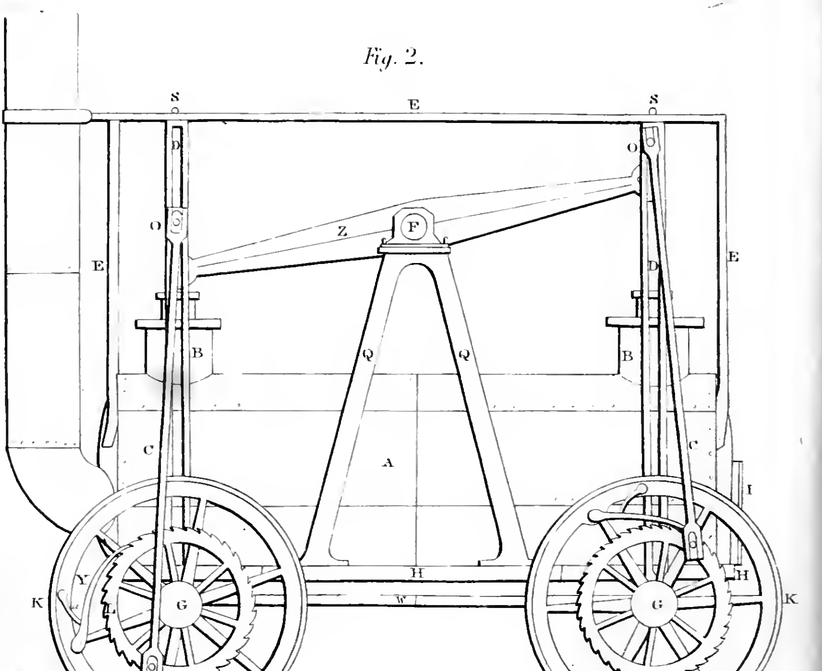


Fig. 2.

Fig. 2.

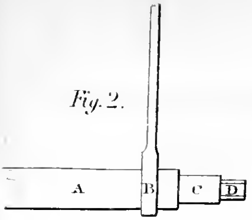


Fig. 1.

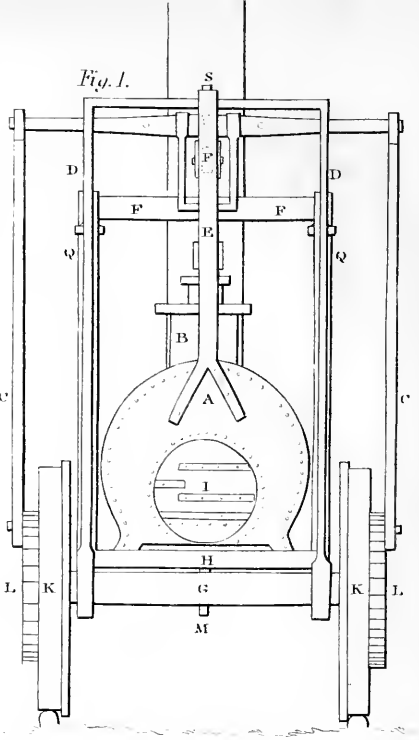


Fig. 3.

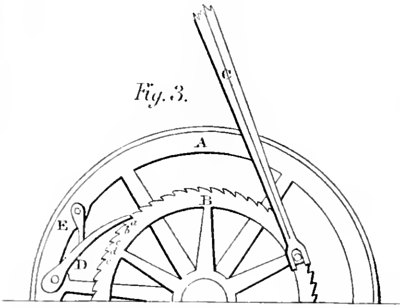
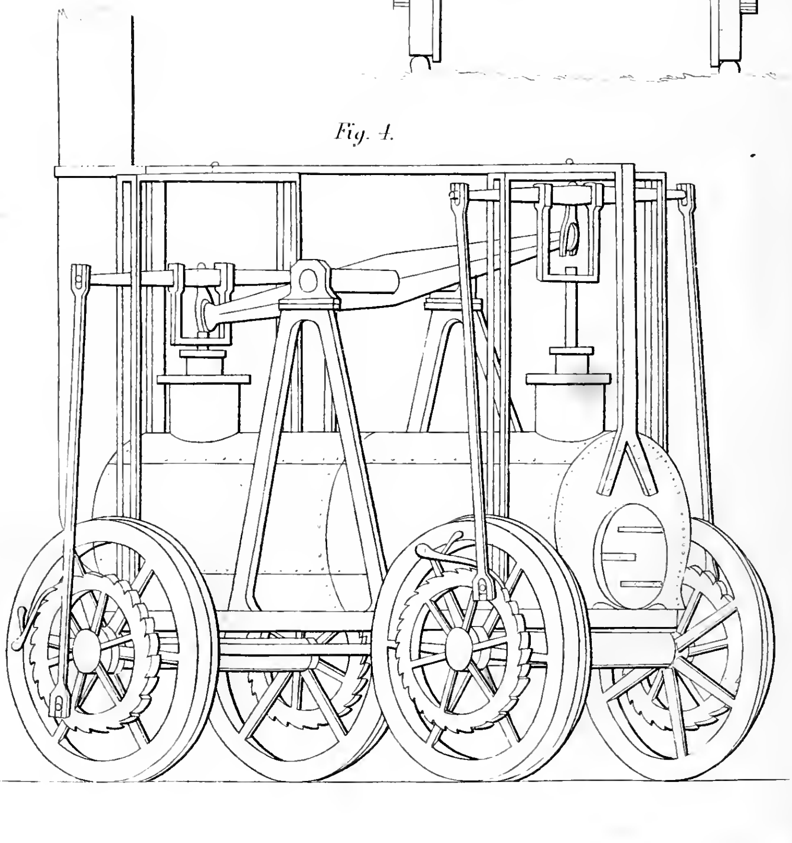


Fig. 4.



or less, apart: these loops pass into holes made in the edge of the hides, skins, &c. and the loops pass through each other, and form a connexion which keeps the hides, skins, &c. to their proper place; or, in lieu thereof, there may be hooks of a curved form, firmly fixed; the hides, skins, or whatever is to be tanned, is to be attached to the surface of the reel, expanded in full width, supported by the loops or hooks; the hooks to be used when liming or bating the surface of the reel, may be fixed from three to six inches under the liquor; in the process of turning the reel forward and backward, it changes the position of the hides, &c. in such a manner as to cause every part of the hide to come in contact with the liquor. This machine surpasses all others in its principle of sinking to the bottom of the vat, when left at rest.

WILLIAM BROWN.

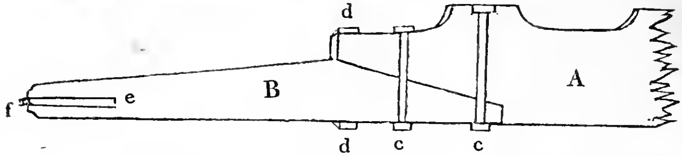
Specification of a patent for an improvement in the common carriage axle. Granted to DANIEL W. PHILLIPS, *of Middlebury, and* WILLIAM MAHER, *of Covington, both in Genesee county, in the state of New York, April 23d,* 1828.

THE principal improvement here intended in the common carriage axle, consists in making the arm, or that part which works in the nave, of cast iron; to be constructed in the following, or a similar manner.

Each arm of the axle is to be cast with a shank for securing it in the stock, and a wrought iron bar in the centre, projecting a little from the smaller end of the arm, on which is cut a screw to receive a nut for securing the wheel on the axle; the end of the arm is also a little depressed and squared, in order to receive a fixed collar, or washer, of the same circumference with the smaller or exterior box in the nave; after this collar is applied, the nut is firmly screwed up to it, and as the collar cannot turn on the axle, the nut is not liable to come off by the action of the wheel. The shank, which is square and tapering on the upper side, and of suitable length, is sunk into the under side of the stock, or wooden part, which connects the two arms and forms the central part of the axle, and is secured by bands and bolts.

The benefits which it is supposed will result from this improvement, in the construction of carriage axles, are, 1st. They can be made at considerably less expense, than those of wrought iron. 2nd. Cast iron being harder, and wearing away much slower, than wrought iron, they will be more durable, and subject to less friction. 3d. By means of the fixed collar, the internal part of the nave is so effectually closed, that no dust or sand can insinuate itself into it.

DANIEL W. PHILLIPS,
WILLIAM MAHER.



The figure represents one half of an axle, and shows the manner in which the arms are attached to the stock.

A, the stock composed of wood.

B, the arm framed into the stock A, and secured by the bolts c, c, and a band, seen at d, d.

e, a bar of wrought iron, cast into the centre of the arm, and terminating in a screw f. This piece may extend to any depth.

Specification of an improvement in the mode of making, or manufacturing, carriage bodies of every description, and of any required shape. Denominated Self-bracing Bodies. Granted to Jesse Reeder, *of Lebanon, Warren county, Ohio, March 4th,* 1828.

1st. The skeleton of the body is formed of tough timber, or iron, made into bows or slats, which, for an ordinary sized coachee body, are about half an inch in thickness, and from a half to an inch and a half in width, when formed of wood, and of a corresponding strength; when iron is the material employed, these slats (of a length to correspond with the length, breadth, height and shape of the body required) are laid down, crossing each other at right angles in the bottom, at from two to ten inches apart, (according to the degree of strength required,) and are fastened together by rivets, screws, or otherwise, where they cross each other in opposite directions.

2nd. The raves or rails for the seats, and top of this body, being of tough timbers, may be so bent as to constitute, in one piece, the sides and ends of the body, so as to turn the corners with a curve, or with a greater or less angle, as desired; or they may be joined together in the usual methods at the corners. It may be here recommended that the bows and rails be steamed, and formed on sets, or moulds, of any desired shape, to suit the fashion of the body intended to be made.

3d. This skeleton when completed, may be enclosed by boards, or with leather, canvass, or other materials in general use; suiting the material to the curvature, or shape of the body. Pannels, if desired in the sections of the body, as also representations of a sunken bottom, may be formed of wooden or plated mouldings, or of any other desired material.

4th. It has been thought necessary by the inventor, in order to render his explanations more explicit, to mention in them, many of the component parts of those bodies now in general use. In this improvement, he, however, claims the sole prior right to the discovery, invention, and construction of the skeletons, of his "self-bracing

bodies," by forming them of slats of wood or iron, so disposed as to extend in single pieces lengthwise the whole length and height of the body; in the same manner extending crosswise; and being fastened together by screws, rivets, or otherwise, where they cross each other at right angles in the bottom. Also, to his method of binding and applying the seat and top raves or rails, for binding the ends and sides of the slats, so as to render the desired shape of the body complete. The particular advantages proposed, in adopting this construction of carriage bodies, are, that they are found to be but of about one-fourth the weight, much stronger, less liable to external injury, and requiring not more than one-fourth of the time, manual labour, and expense in materials, that are necessary to the construction of any bodies now in general use.

JESSE REEDER.

On the causes which produce, and the circumstances which affect, the Draft in Chimnies; intended as an answer to the queries of "A Citizen of New Jersey," inserted in the Journal of the Franklin Institute for March, 1829.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

SIR,—I submit for insertion in your Journal, the subjoined replies to some of the queries of a citizen of New Jersey, which appeared in the No. for March.

Yours, &c.

MARCUS BULL.

1. *Upon what principle does the draft of an air furnace depend?*

The "draft," or, more properly, the current of air through a chimney, is produced, in consequence of air possessing the property of expansion when subjected to heat, by which expansion its specific gravity is decreased. The column of air within the chimney when heated, dilates, and thereby becoming lighter than the surrounding air, it is forced to ascend the chimney by the superior pressure of the column of cold air, and thus the current is established.*

2nd. *What effect will an increased height of the chimney have on the draft?*

In some cases an injurious, and in others a beneficial effect. The proper height of a chimney, to produce the most powerful combustion in the furnace, is governed by particular circumstances. If the furnace, or receptacle for the coals, be of large dimensions, and capable of producing great heat, and the chimney be constructed of materials which are bad conductors of heat, its height may with advantage be greater, than should be the case if the furnace be small,

* Your correspondent may be assured there is no *drawing* about the matter, and, although it might sound rather oddly, it would be more correct to say that a chimney *drives*, or *pushes* well, than that it *draws* well.

and the chimney composed of materials which are good conductors of heat.

Chimnies are intended to enclose and convey away the gaseous products of combustion, smoke, &c., and to prevent their dispersal, so long as they retain sufficient heat to render them more rare than a column of the external air, equal to the contents of the chimney; hence, the propriety of constructing them of materials which are bad conductors of heat.

The quantity of air passing through a well constructed furnace in a given time, will be proportional to the difference in *temperature*, or specific gravity, between the columns of air within and without the chimney, and to their *height*. In theory, we should suppose, all other things being equal, that the height of a chimney should be such that the ascending current would leave it at the temperature which would allow its specific gravity to be precisely that of the external air, as this would give the longest rarified column; but, as the temperature of the air both within and without the chimney varies almost constantly, experience suggests the propriety of constructing chimnies of such height only, as will permit the smoke, &c. to pass off whilst considerably rarified, under all states of the weather; but no experiments have been made to determine the precise difference in temperature at which the ascending column should be permitted to escape; *and this*, indeed, must vary with every difference in the nature of these products of combustion, dependant upon the more or less perfect decomposition of the air in passing through the furnace.

3d. *If an increased height of the chimney increases the draft, what is the ratio?*

All other things being equal, the ratio of increase will depend on the materials and area of the chimney; but in all cases this latter must diminish as we increase its height, the first foot producing more effect than the second, and the fifth more than the tenth, &c.

If the chimney be composed of materials which are bad conductors of heat, the included column will cool at a slower rate than if the materials made use of be good conductors of heat; consequently, the ratio of increase must vary through any given space. In like manner, the cooling of a large and a small column will be at different rates.

From the results of Mr. Dalton's experiments to determine the expansion of air by heat, it appears that from 32° to 212° of Fahrenheit, every 45° of temperature produces an expansion of about $\frac{1}{10}$, which will reduce the absolute weight of any given volume so expanded, $\frac{1}{20}$; but as the products of combustion possess greater specific gravity than an equal volume of the external air at the same temperature, and as these vary, we cannot estimate the precise difference in the pressure of the two columns merely from their difference in temperature.

4th. *What effect will an increase or diminution of the superficial area of the chimney have on the draft?*

If the passage for the aeriform products be too small to allow them

to escape freely, the quantity of air which would otherwise pass through the furnace in a given time, is diminished, and the combustion is, consequently, retarded. If, on the other hand, the passage be larger than is necessary for their free escape, the sides of the chimney will also present a larger refrigerating surface, which reduces the temperature of the included air more rapidly, and, consequently, increases its specific gravity, by which the velocity of the current is impeded.

To produce the most intense combustion, it is necessary that the furnace be perfectly supplied with air, and when that portion of it which may remain undecomposed, together with the products of combustion, shall have passed through the furnace, what is ordinarily called the draft, must be such as to force them to escape through the chimney with the greatest velocity, as that furnace which will consume the largest quantity of air and coals in a given time, must necessarily produce the greatest amount of heat; but no satisfactory experiments have as yet been made to ascertain the proportions which should exist between the various parts; hence data are wanting to proceed upon principle, and we can only accomplish the end in view by repeated trials.

5th. Will a chimney largest at its top, or vice versa, make the strongest draft?

As that portion of the column of heated air, &c. nearest the burning coals, must necessarily be the most expanded, and require more room than at the top of the chimney, where their temperature and volume are diminished, a chimney largest at the bottom, must be better calculated to promote a rapid current through it, than the same chimney with its apex reversed.

6th. Is it important, as regards the draft, that the materials of which a chimney is composed, be good conductors of heat, or otherwise?

It is very important that the materials be *bad* conductors of heat, that the included column of air, &c. may be cooled by the slowest process. The advantage of this has already been stated in the answers to some of the preceding questions.

7th. What is the best mode of binding the chimney of an air furnace, to prevent its cracking?

This is a question so entirely practical, that the answer, to have any value, must be given by one who has had much experience on this subject: the writer of the foregoing replies will not, therefore, attempt it, but hopes that some liberal iron master, or founder, will afford the required information, which, whilst it may give strength to his neighbours' chimnies, will not have the effect of weakening his own.

Observations on an apparatus to illustrate the Composition and Resolution of Forces, and to measure the power obtained by certain parts of machinery operating on this principle. *By* WALTER R. JOHNSON, Principal of the High School of the Franklin Institute.

THE great number of operations in practical mechanics, which involve the composition and resolution of forces, renders it important that the calculation of oblique forces should be made familiar and easy.

The proposition so well known in theoretical mechanics, under the name of the *parallelogram of forces*, does not appear to be sufficiently understood, since we occasionally find the strangest violations of its laws, in the constructions which artisans are called upon to execute.

This circumstance has induced me to attempt to present the subject under such aspects as may free it from doubt, and enable the practical mechanic to understand and apply, at least in ordinary cases, the principles involved.

To be convinced of the importance of this subject, we need only refer to the fact, that the supporting of bridges, whether on chains, timbers, or arches, is obviously dependent on the laws of equilibrium between oblique forces. Even the trussing of girders in common buildings, and the sustaining of arches, for whatever purpose, must be referred to the principle of *resistances applied in directions not parallel to that of the force which tends to produce motion, but with some degree of obliquity to that direction.* Where intensity of action, and not extent of space, is the main object of a mechanical implement, the principle of oblique forces furnishes a variety of means for attaining the desired end.

The common apparatus employed for demonstrating this subject, consists of three cords, joined at one point by a knot, at, or near the centre of a circular horizontal table; the free end of each cord passing over a pulley to sustain a weight. When the weights are equal, and the three pullies are adjusted at equal intervals round the circumference of the table, the knot remains at the centre of the table, and each angle formed by two contiguous cords, is, of course, 120°. By varying the weight on one or two of the cords, different angles may be formed at the point of union; but, in this case, if we would preserve the knot at rest in the centre of the table, the positions of all the pullies must be changed with each variation of weight.

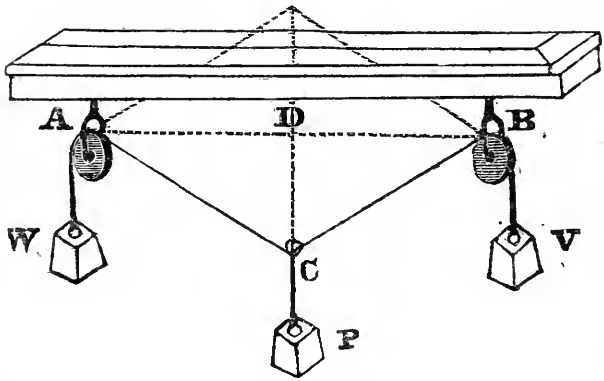
In all cases of equilibrium, the weight attached to each cord, or, what is the same thing, the tension sustained by it, will be in proportion to the *sine* of the angle formed by the directions of the other two.

If, instead of cords attached to a fixed point, or, what is the same thing, *fixing their knot to a given point in space, by their own equilibrium*, we suppose the two ends of a cord to be attached to two fixed points in the same horizontal line, and to hang somewhat loosely between them, and that a weight be suspended to this cord by a

pulley, ring, or sliding knot, so as to pass easily from one part of the cord to the other, then the weight will find the lowest point to which the cord will allow it to descend, when it hangs in the centre. The two parts of the fixed cord will then be of equal lengths, sustain equal tensions, and form equal angles with the vertical direction of the line which supports the weight.

Now the force which stretches the fixed cord, represented in the figure below by the two weights W and V, may be conceived to produce two different effects, one tending to bring the pins, or hooks, to which it may be attached, nearer to each other, and the other to bring them downwards in obedience to the gravity of the weight. These two effects may be represented in amount by the respective lengths of a vertical and a horizontal line meeting at a point perpendicularly above the pulley to which the weight is attached.

The figure annexed will render this intelligible.



If the lines CA and CB, be supposed to represent inflexible rods, and the points of attachment A and B, be capable of sliding along a rod, or wire, towards D, then the weight P remaining always the same, the two wires CA, CB, must sustain the same tension as when they were flexible cords; but the resistance to a horizontal motion in the direction AD, or BD, is what we have to measure. The tension of CB produces two different effects, one in the direction DB, the other in that of DC; and the lengths of these two lines respectively express the intensities of the forces into which CB is decomposed. But as CB is always of the same length, whatever its inclination to AB, it may be taken as the radius of a circle, and then DB becomes the *cosine* of the angle CBD, but the *sine* of DCB, or of its supplement PCB; and DC is the *sine* of CBD, but the *cosine* of DCB, or of its supplement PCB. The effect of the tension of CB towards sustaining the weight P, is, therefore, expressed by the line CD, or the *sine* of the angle of depression of the wire CB. But the tension of CA produces another similar effect, and to the same amount; of the two, therefore, the sustaining force is expressed by the double of CD, or

twice the sine of the angle of depression. This is represented by DE, the diagonal of the parallelogram AEBC. If we suppose the points of attachment, A and B, to be prevented from approaching each other by cords passing over pullies at some distance from these points respectively, but in the direction of AB produced, the weights which would be required to retain the points in their present positions, would be, to the weight suspended at C, as the length of AD, and of BD, respectively, to the length of DC. But these two lines have to each other the relation of the *cosine* to the *sine* of the angle of depression, and these two quantities will vary with every change of the angle, so that when one of the forces is constant, it becomes necessary for convenience in practice, to substitute for the relation of *cosine* to *sine*, its equal, viz. that of *radius* to the *tangent* of the angle of depression.

We may readily perceive that when the two wires are brought into a horizontal position, as there is no angle of depression, there can, of course, be no tangent, or the tangent will be represented by zero; whence the weights which draw the points A and B apart, must be to the weight which is suspended at the centre, as a finite quantity to one infinitely small, or nothing. Or if the weight hung upon the centre be of finite magnitude, the forces which draw the points A and B apart, must be infinitely great.

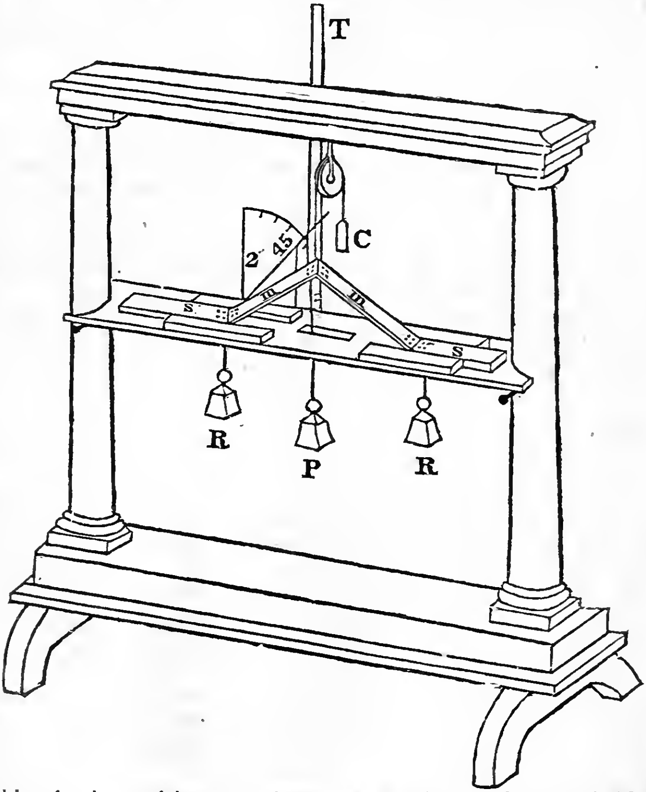
When, on the contrary, the two wires, AD, BD, come to a vertical position, the angle of depression is 90°, whose *tangent* is infinite. The relation, therefore, between the *radius* and *tangent*, is, in this case, indefinitely great. The whole weight is sustained by the horizontal rod to which the others are attached, and no force, however small, can be applied in a horizontal direction, tending to separate the upper ends of the wires, without actually drawing them apart, provided they move without friction, or other modifying cause.

Thus we find the two extremes of this modification of the apparatus.

Let us now suppose the whole to be reversed, and the *traction* to be converted into *pressure*. This will give us the same conditions, and furnish an opportunity of testing, by actual experiment, the truth of the principles above examined.

For this purpose, on the horizontal plane in the middle of the frame, as represented in the following figure, are two planes, S, S, sliding in grooves, which confine them in the lateral directions, and furnished beneath, each with four friction rollers, on which they move with great facility in the longitudinal direction. The supporting plane is furnished with two pullies, over which cords pass, along a groove in the same, until they are finally attached to hooks at the two exterior ends of the sliding planes, S, S. When the weights R, R, are attached to the lower ends of these cords, they exert their whole force in urging the sliding planes towards each other. m, m, are two moveable planes, united together by a hinge, and each likewise connected with one of the sliding planes by a hinge, so that the four planes may either form one continued horizontal plane, or that the two moveable ones may rise to any angle with the horizon,

and be retained there by the weight P, suspended at the pin of the middle hinge, or may even come to a vertical position, in which latter case their under sides, or faces, rise together and come into immediate contact. The only difference between the case of the two wires before supposed, acted upon by *traction*, and of the two moveable planes now presented, acted upon by *pressure*, is, that in the former case, every equilibrium is *stable*, while in the latter, it is *unstable;* that is, when once destroyed, instead of returning to the position of equilibrium, the planes are urged with a constantly increasing force towards one or the other of the extreme positions of the apparatus. But this circumstance only serves to render more striking the actual equilibrium which may be produced, and in practice, no difficulty whatever is found in sustaining the parts of the



machine in the positions required. A weight equal to one half that of the two moveable planes, is suspended by a small cord passing over a pulley, in order to deprive those planes of the effect of *gravity of parts*, which would otherwise materially influence the conditions of equilibrium. This counterpoise is seen at C.

In order accurately to measure the angle of elevation, a quadrant

(2) whose radius is of the same length as that of one of the moveable planes, is attached to the platform, and may slide along its edge horizontally, so as in every situation to adjust its centre precisely to the pivot of the lower hinge of that plane to which it is applied. The pivot of the middle hinge will then correspond to some point on the *arc*, and if the latter be divided into degrees and parts, the requisite data are immediately obtained, and the calculation is made with the utmost facility, by means of a table of tangents. Or a tangent rod T, as represented in the figure, may be added, having, on one side, lines drawn through the several divisions of the quadrant as far as convenient, and on the other, a scale of equal parts. The force P, then, is to one of the forces, R, as twice the tangent of the angle of elevation is to radius.

The machine which I have employed for this purpose, and which is represented in the figure, is about four feet in length by three feet and a half high; the moveable planes are about $10\frac{1}{2}$ inches in length, by $1\frac{3}{4}$ in breadth, and the sliding planes 12 inches in length by $2\frac{1}{4}$ in width.

The earliest account which I have seen of any mechanical implement constructed on the principle presented by this apparatus, is one contained in an old work by Ven Mandy, published near the beginning of the last century, where it is called an "augmenting power or force," and is merely described, without any investigation of its principle of action. It is there presented as a device adopted by a baker to facilitate the process of kneading his dough. It has of late years been applied to a variety of useful purposes, such as the construction of oil and printing presses, the cutting and perforating of metals, and other operations in which intense action through a very limited space is required to be produced by means of a small moving force.

Different names have been proposed for this kind of mechanical power, but none has yet obtained, I believe, a general adoption.

The term "*toggle joint*," is neither good English, nor in any way appropriate to the subject. The name of "progressive lever" has sometimes been applied to it; but from what has preceded, it will be seen that it has nothing in common with the ordinary lever, and though the latter may sometimes be employed as the medium through which the moving force is applied, yet it constitutes no essential part of the machine, any more than if applied to the middle of a cord to increase the tension in the *rope machine*. In reference to the mode of uniting the planes by *hinges*, or other equivalent means, I have proposed the term *cardinary power*, and to the particular apparatus above described, have given the name of *tricardo*.

On the Influence of the Air in determining the Crystallization of Saline Solutions. By THOMAS GRAHAM, ESQ. A. M. F. R. S. E.*

THE phenomenon referred to has long been known, and popularly exhibited in the case of Glauber's salt, without any adequate ex-

* From the Transactions of the Royal Society of Edinburgh; but revised by the Author for the Phil. Mag. and Annals.

planation. A phial, or flask, is filled with a boiling saturated solution of sulphate of soda or Glauber's salt, and its mouth immediately stopped by a cork, or a piece of bladder is tied tightly over it, while still hot. The solution, thus protected from the atmosphere, generally cools without crystallizing, although it contains a great excess of salt, and continues entirely liquid for hours, and even days. But upon withdrawing the stopper, or puncturing the bladder, and admitting air to the solution, it is immediately resolved into a spongy crystalline mass, with the evolution of much heat. The crystallization was attributed to the pressure of the atmosphere suddenly admitted, till it was shown that the same phenomenon occurred, when air was admitted to a solution already subject to the atmospheric pressure. Recourse was likewise had to the supposed agency of solid particles floating in the air, and brought by means of it into contact with the solution; or it was supposed that the contact of gaseous molecules themselves might determine crystallization, as well as solid particles. But although the phenomenon has been the subject of much speculation among chemists, it is generally allowed that no satisfactory explanation of it has yet been proposed.

In experimenting upon this subject, it was found that hot concentrated solutions, in phials, or other receivers, might be inverted over mercury in the pneumatic trough, and still remain liquid on cooling; and thus the causes which determine crystallization, were more readily examined. For this purpose, it was absolutely necessary that the mercury in the trough should be previously heated to 110° or 120°; for otherwise, that part of the solution in contact with the mercury cooled so rapidly, as to determine crystallization in the lower part of the receiver, long before the upper part had fallen to the temperature of the atmosphere. In such cases, crystallization beginning on the surface of the mercury, advanced slowly and regularly, through the solution. Above, there always remained a portion of the solution too weak to crystallize, being impoverished by the dense formation of crystals below. It was also necessary to clean the lower and external part of the receivers, when placed in the trough, from any adhering solution, as a communication of saline matter was sometimes formed between the solution in the receiver and the atmosphere without. When these precautions were attended to, saline solutions over mercury remained as long without crystallizing, as when separated from the atmosphere in the usual mode.

Solutions which completely filled the receivers when placed in the trough, allowed a portion of mercury to enter, by contracting materially as they cooled. A bubble of air could thus be thrown up, without expelling any of the solution from the receiver, and the crystallization determined, without exposing the solution directly to the atmosphere.

The first observation made, was, that solutions of sulphate of soda sometimes did not crystallize at all upon the introduction of a bubble of air, or at least for a considerable time. This irregularity was chiefly observed in solutions formed at temperatures not exceeding

150° or 170°, although water dissolves more of the sulphate of soda at these inferior temperatures, than at a boiling heat. Brisk ebullition for a few seconds, however, rendered the solution upon cooling amendable to the usual influence of the air. In all successful cases, crystallization commenced in the upper part of the receiver around the bubble of air, but pervaded the whole solution in a very few seconds. A light glass bead was thrown up into a solution without disturbing it.

It occurred to me, that, since the effect of air could not be accounted for on mechanical principles, it might arise from a certain *chemical* action upon the solution. Water always holds in solution a certain portion of air at the temperature of the atmosphere, which it parts with upon boiling. Cooled in a close vessel after boiling, and then exposed to the atmosphere, it re-absorbs its usual proportion of air with great avidity. Now, this absorbed air appears to affect in a minute degree, the power of water to dissolve other bodies; at least, a considerable part of it is extricated upon the solution of salts. When a bubble of air is thrown up into a solution of sulphate of soda, which has previously been boiled and deprived of all its air, a small quantity of air will certainly be absorbed by the solution around the bubble. A slight reduction in the solvent power of the menstruum, will ensue at the spot where the air is dissolved. But the menstruum is greatly overloaded with saline matter, and ready to deposit it; the slightest diminution of its solvent power may, therefore, decide the precipitation or crystallization of the unnatural excess of saline matter. The absorption of air may, in this way, commence and determine the precipitation of the excess of sulphate of soda in solution.

Here, too, we have an explanation of the fact just mentioned, that solutions of sulphate of soda which have *not* been boiled, are less affected by exposure to the air than well boiled solutions; for the former still retain the most of their air, and do not absorb air so eagerly on exposure, as solutions which have been boiled.

But the theory was most powerfully confirmed by an experimental examination of the influence of other gases, besides atmospheric air, in determining crystallization. *Their influence was found to be precisely proportionate to the degree in which they are absorbed or dissolved by water and the saline solutions.*

To a solution of sulphate of soda over mercury, which had not been affected by a bubble of atmospheric air, a bubble of carbonic acid gas was added. Crystallization was instantly determined around the bubble, and thence through the whole mass. Water is capable of dissolving its own volume of carbonic acid gas, and a solution of sulphate of soda as strong as could be employed, was found by Saussure to absorb more than half its volume.

In a solution of sulphate of soda, which was rather weak, both common air and carbonic acid gas failed to destroy the equilibrium; but a small bubble of ammoniacal gas instantly determined crystallization.

When gases are employed which water dissolves abundantly, such

as ammoniacal and sulphurous acid gases, the crystallization proceeds most vigorously. It is not deferred till the bubble of gas reaches the top of the receiver, as always happens with common air, and frequently with carbonic acid gas; but the track of the bubble becomes the common axis of innumerable crystalline planes, upon which it appears to be borne upwards; and sometimes before the ascent is completed, the bubble is entangled and arrested by crystalline arrangements which precede it.

The number of gases which are less soluble in water than atmospheric air, is not considerable; but of these, hydrogen gas was found to be decidedly least influential in determining crystallization.

Minute quantities of foreign liquids, soluble in water, likewise disposed the saline solution to immediate crystallization, as might be expected, and none with greater effect than alcohol. It is known that alcohol can precipitate sulphate of soda from its aqueous solutions. The soluble gases I suppose to possess a similar property.

These facts appear to warrant the conclusion, that air determines the crystallization of supersaturated saline solutions, by dissolving in the water, and thereby giving a shock to the feeble power by which the excess of salt is held in solution.

⁂ Since the foregoing observations were printed, the author has perceived that M. Gay-Lussac, in his paper on crystallization, (*Ann. de Chim.* tom. lxxxvii.) had distinctly thrown out the same theory as a conjecture, although the circumstance is not noticed by any systematic chemical writer. But as M. Gay-Lussac brings forward no experimental illustration of the theory, and, indeed, adduces one experiment as unfavourable to it, the experimental confirmation of the theory is novel, and was certainly required. [*Phil. Mag.*

On some new modes of forming Pyrophorus. *By* M. Gay-Lussac.

M. Gay-Lussac, in forming this substance, used calcined lamp-black instead of honey or flour, usually employed. Potash-alum heated with this form of carbon, gave at first carbonic acid and sulphurous gas, and nearly in equal volumes; afterwards carbonic acid was obtained nearly pure, and at last it was mixed with oxide of carbon, and this eventually prevailed. The pyrophorus so formed, burnt readily. M. Gay-Lussac is of opinion, that carbon is not necessary to the combustion: he made a mixture of nearly 75 parts of alum, and 3.33 of lamp-black, or 1 atom of the former and 3.5 atoms of the latter; and this mixture, when calcined, at nearly a white heat, gave a reddish-brown product, containing no traces of carbon, but it burnt very readily, and left a grayish-white residuum. Alum is not essential to the preparation. Sulphate of magnesia produces the same effect; sulphuret of potassium alone does not, however, inflame spontaneously in mass; and it occurred to M. Gay-Lussac, that alumina, or magnesia, acted merely by dividing the sulphuret; that this was the case, was proved by substituting charcoal for them,

and though the compound obtained, by using 27.3 of sulphate of potash, or 1 atom and 7.5 of lamp-black, or 4 atoms agglutinated, and did not inflame; yet, on using double the quantity of lamp-black, the pyrophorus obtained was extremely pulverulent, and was astonishingly inflammable, so much so as to be almost dangerous.

This pyrophorus yields no sulphurous acid during combustion; when put into water, it gives no hydrogen, showing that there is no uncombined potassium; and when the solution is treated with an acid, sulphuretted hydrogen is evolved, and sulphur precipitated. Unlike common pyrophorus, it does not require moist air for its combustion: the charcoal does not appear to be in a state of combination, for the aqueous solution of the pyrophorus is not distinguishable from that of sulphuret of potassium, made without charcoal; and this latter substance is so readily deposited in the vessel, as not to indicate that state of minute division which is characteristic of previous combination.

The new pyrophorus, compared with the common, appears to owe its greater inflammability to several causes: to its more minutely divided state, the absence of inactive earthy matter, and also to the smaller proportion of sulphur. Sulphate of soda, used in equivalent proportion, produces nearly the same effect as sulphate of potash; but sulphate of barytes did not at all answer. M. Gay-Lussac is of opinion, that the action of potassium depends essentially upon the great combustibility of sulphuret of potassium, and its action upon water and air: alumina and magnesia appear only to divide the combustible matter; but charcoal, being itself combustible, is not passive in the phenomena; the combustion having once commenced, it supports it. A very high temperature did not appear to alter the inflammability of the pyrophorus, provided that, during the cooling, the air was carefully excluded. [*Ann. de Chim.*

Account of a cheap and easily constructed Barometer for measuring Altitudes, &c. By Mr. J. Otley.

Gentlemen,—Observing in a late number of the Philosophical Magazine,* a proposal by Mr. Nixon, for determining the heights and dip of strata by barometric observations, I take the liberty of offering a description of an instrument I have lately constructed, which, I think, particularly applicable to that purpose, as well as to the measurement of any elevation where a barometer can be employed.

I procured a straight barometer tube, thirty-three inches in length, and also a bottle one inch in diameter, and the same in depth. In one side of this bottle, near the top, I bored a small hole; and having filled the tube with mercury, and the bottle rather more than half full, I inserted and cemented the tube into the neck of the bottle,

* See Phil. Mag. and Annals, N. S. vol. iii. p. 11.

with its open end a little below the middle, so that in every position the opening was covered with mercury.

I then fitted the whole into a casing of wood, the tube, for twenty-five inches of its length, being imbedded level with the surface; the upper end opposite the scale, for the length of eight inches, being fully exposed. The divisions of the scale denoting inches and tenths, are reduced a little, to compensate for the variation of the surface of the mercury in the cistern. For a vernier, I took a very thin piece of silver, the length of eleven divisions of the scale, and breadth something more than half the circumference of the tube; this divided into ten parts by lines quite across, except a small space for the figures, and bent so as to embrace the tube with a gentle elastic pressure, is made to slide as freely as required: the lines of the scale being reflected from the surface of the silver, afford great assistance in observing the coincidence, dividing the inch very accurately into a hundred parts; and a figure in the third place of decimals, may be estimated by the eye. The lower part of the case being secured by a piece of thin brass plate, with a bottom projecting in front beyond the diameter of the bottle, I fit a wooden cover, the whole length of the instrument, with two pins to pass into corresponding holes in the bottom plate: a bit of soft leather is placed so as to press on the mouth of the hole in the bottle, and the case, being made a little taper, is easily kept close by a slight hoop of leather.

This barometer, with a moderate degree of precaution, is sufficiently portable, and very ready in use; it requires no other preparation for an observation, than merely to hang it perpendicularly, and take off the cover: the air having immediate access to the surface of the mercury in the cistern, renders it more satisfactory than those in which it has to pass through the pores of the wood, and where the surface of the mercury cannot be seen; and less troublesome in use, with less risk of error, than others, in which it has to be adjusted by a screw for every observation.

If a due proportion is attained in the divisions of the scale, and proper attention paid in taking a mean observation at each station, to obviate the effects of the friction unavoidable in small tubes, I am convinced that it will be found as accurate as any barometer of the same dimensions, although of a far more elaborate and expensive construction.

I am, &c. J. Otley.

Keswick, August 7th, 1828. [*Phil. Mag.*

Efficacy of Ammonia in counteracting Poison; extract of a letter from Dr. Austin Church, to Professor Silliman, dated Cooperstown, New York, Feb. 6, 1829.

A young man in this place, had accidentally overset a hive of bees, and before he could escape, they had settled, in great numbers,

on different parts of his body and limbs, and stung him very severely. It was about half an hour after the accident happened, when he came to my office in great agony, and he had scarcely time to give an account of it, before he fainted. I immediately applied the ammonia to the parts that had been stung; his legs, arms, and breast. He directly recovered from his faintness, and experienced no pain or other inconvenience afterwards.

It is several years since I first used the aqua ammonia, to counteract the effect of the bites of insects, and stings of bees, and it has invariably produced instant relief—generally complete. I have often seen children crying in excessive pain from the sting of a bee, and on the application of the ammonia, they would immediately cease complaining, and become cheerful; so complete and sudden is the relief it produces. I always use it for moschetto bites, and they never trouble me farther. I was led to the use of it in these cases, from the instantaneous effect it was said to have in counteracting the operation of prussic acid. In the second number of the American Journal of Medical Sciences, (Philadelphia,) for last year, it will be seen that Dr. Moore, of Alabama, used it with great success in the cure of bites of venomous serpents. From his account, it is probable that the pure uncarbonated aqua ammonia is most efficacious. I have noticed that at sometimes the application is more efficacious than at others, and I think it must be on account of its being sometimes carbonated, and at others not. [*Silliman's Journ.*

Franklin Institute.

Experiments on Water Power.

The undersigned, a committee appointed by the board of managers of the Franklin Institute, under the foregoing resolutions, (see Journal of the Franklin Institute for March, page 217,) have determined, after due consideration, that the object of the Institution, and the wishes and interest of the public, will be much better attained by having at their command a head and fall of 22 feet. They have, accordingly, applied to the City Councils, for liberty to use water from the conduit pipes, from which such a head can easily be obtained; this privilege has been cheerfully granted.

The sum of seven hundred dollars has already been subscribed; and it is believed by the committee, that the further sum of eighteen hundred dollars will be sufficient to bring the experiments to a satisfactory and successful issue.

That the public may be able to form an idea of the magnitude and importance of the undertaking, the following brief outline of the views of the committee is submitted.

It is intended to use wheels of various sizes, from two feet in diameter, up to twenty; to ascertain the maximum effect of each wheel separately, as it relates to the quantity and head of water to be used; the place of its delivery on the wheel; the form of the gate;

and shape, position, and size, of the buckets, or floats; to ascertain the relative powers of the same wheel when used as an undershot, breast, and overshot; also, to compare the powers by different wheels (when used in these three different manners) with each other, when the same and different heads are used, and when the same and different quantities of water are used, and thus to ascertain with what head and fall it is best to use the different kind of wheels, having regard also to the quantity of water employed. In general, to ascertain the means of employing any given quantity of water with a given head and fall so as to produce a maximum effect.

In arriving at this general result, many particulars, besides those enumerated, will, of course, be established; such as the relative velocity of the wheel and stream in the case of undershots, when the effect is a maximum; whether the effect increases with the head in the same ratio for undershots as for overshots.

In conducting these experiments, the committee will not take their own theories, or those of others, for granted; but they will endeavour to establish every principle upon the solid basis of experiment.

The committee now confidently call on every liberal minded citizen of this republic, to aid the Institute with *mind* and *money* to carry into successful operation, these highly useful and interesting experiments.

Any sum enclosed to either of the undersigned, for the purpose named above, will be thankfully received, and any experiment proposed by the donor, if compatible with the views of the Institute, shall be performed, and the result, with the name of the proposer (unless otherwise directed,) shall be inserted in the Journal of the Institute, with the general report, at the termination of the experiments.

It is desired that contributors will send in their contributions before the first of June, as the Institute wishes to terminate the experiments this autumn.

S. V. Merrick,	M. W. Baldwin,	Committee.
Benj. Reeves,	John Levering,	
Isaiah Lukens,	John Agnew,	
Rufus Tyler,	Samuel Haines,	
Andrew Young,	James P. Espy,	

Hall of the Franklin Institute, May 1829.

LIST OF ENGLISH PATENTS

Which passed the great seal, from December 22, to January 19, 1829.

William Parr, Gentleman, and James Bluett, Ship Joiner, Mast, and Block Maker, and Pump Maker, for a new method of producing a reciprocating action, by means of rotary motion, to be applied to the working of all kinds of pumps and other machinery, in or to which reciprocating action is required, or may be applied—December 22.

George Rodgers, Cutler, Jonathan Cripps Hobson, Merchant, and Jonathan Brownill, Cutler, for certain improvements on table forks —December 23.

Orlando Harris Williams, Esq. for certain improvements in the paddles and machinery for propelling ships and other vessels on water—January 7.

Septimus Gritton, Surgeon, and late of the Royal Navy, for an improved method of constructing paddles to facilitate their motion through water—January 7.

Francis Neale, Barrister at Law, for a machine, apparatus, or combination of machinery, for propelling vessels—January 7.

William Taft, Harness Maker, Saddler, and Bridle Cutter, for certain improvements in, or additions to, harness and saddlery, part or parts of which improvements or additions are applicable to other purposes—January 7.

Archibald Robertson, Ship Carver, for certain improvements in the construction of paddles, for propelling ships, boats, or vessels on water—January 7.

James Deakin and Thomas Deakin, Merchants, and Manufacturers of Hardware, and partners, for certain methods of making from horns and hoofs of animals, various articles; namely, handles of knives, handles and knobs of drawers, and other parts of cabinet and household articles, curtain rings, bell pulls, door handles and knobs, key hole escutcheons or coverings, and door and window shutter finger plates, knobs, and handles; all, or any of which articles, are to be so made of one or more piece or pieces of horn or hoof, of any shape or device, plain or ornamental, or inlaid or conjoined with any kind of metal or other material—January 14.

John Dickinson, Paper Manufacturer, for a new improvement in the method of manufacturing paper by machinery, and also a new method of cutting paper and other materials into single sheets or pieces, by means of machinery—January 14.

Thomas Smith, Engineer, for an improved piece of machinery, which, being combined with parts of the steam engine, or other engines, such as pumps, fire engines, water wheels, air pumps, condensers, and blowing engines, will effect an improvement in each of them respectively—January 14.

John Cheek Hewes, Engineer, for various improvements in the form and construction of windmills and their sails—January 14.

John Udny, Esq. for certain improvements on the steam engine—January 14.

William Erskine Cochrane, for an improvement in or on paddle wheels, for propelling boats and other vessels—January 14.

James Moore Ross, Ironmonger, for an improved tap, or cock for drawing off liquids—January 19.

LIST OF FRENCH PATENTS

Granted in the second quarter of 1828.

To Thomas M'Culloch and Brunelson, of Tarrare, for dressing all sorts of cotton, cambrics, &c.—10 years.

To Jerome Gerneys Chatelain, of Chaument, for a machine to sew—5 years.

To Isidore Christoffle, of Paris, for a new process of manufacturing buttons of horn, &c.—10 years.

To James Francis Adams, of Paris, for a new method of binding books—10 years.

To Parfait Modeste Carpentier, of Paris, for improvements to his patent bed-chair—15 years.

To Victor Lemitayor, of Fecamp, for improvements in a drawing machine—5 years.

To Antoine Christoffle, junr. of Paris, for improvements in his patent for manufacturing buttons—10 years.

To Strasguth and Kress, of Colmar, for a machine to split skins—5 years.

To Samuel Morton, of London, for a process to extract diamonds, gold, silver, and other metals, from earthy matters—10 years.

To Jean Baptiste Letheidier, of Bourdeaux, for a method to learn to write, he calls "triangulaire"—5 years.

To Julis Ferigire, of Paris, for a spout, or beak, for lamps—5 years.

To Henry Pape, of Paris, for a new harmonical table to piano-fortes—10 years.

To Jean Baptiste Carran, senior, of Lyons, for manufacturing stockings, &c.—5 years.

To Hector Chateouneuf and Grandboulogne, of St. Jean, for a steam stove—5 years.

To Parre Versepuy, of Rium, for a stone cement—5 years.

To Stoltz, of Paris, for a pumping machine of centrifugal power—5 years.

To Francois Douaisses, of Paris, for manufacturing wooden buttons—5 years.

To Emile Martin, of Fourchambault, for iron bedsteads—5 years.

To John Collier, of Paris, for improvements to his patented weaving loom—15 years.

To Elie Joel and Conte, of Paris, for a process of manufacturing sealing wax—5 years.

To Onesiphore Pecquair, of Paris, for new machinery used in applying steam to propel coaches, &c.—15 years.

To Gourgii Desroches, of Perrome, for a process to cure sour wines—10 years.

To Gaspar Abrard, junr. of Aix, for an apparatus in spinning silk—5 years.

To Joseph Nicolas Perrin, of Paris, for a night lamp—5 years.

To Aschermann and Perrin, of Paris, for a machine to shave skins—10 years.

To Henry Joseph Pohlin, of Paris, for damping or sponging cloth—10 years.

To Charles Oge Barbaroux, of Paris, for a panorama he calls, "traveller"—5 years.

To Joseph Goulofret, junr. of Versailles, for improvements in a machine for drawing cotton—10 years.

To Francois Gabriel Lehoult, senior, for an improved drawing machine in manufacturing cotton twist—5 years.

To Jacques Defontenay, of Paris, for improvements in manufacturing buttons, with divers materials, like silk buttons—5 years.

To Garcon-Malar, of Paris, for a mill with rollers—15 years.

To Jean Louis Tellier, of Amiens, for a litter-carriage—5 years.

To Thomas Revillon, of Macon, for improvements on his balance press—15 years.

To Jean Batiste Vallier, of St. Denis, for a mechanical loom—10 years.

To Narcisse Decrotoy, of Amiens, for a machine to improve carriages, he calls "perpetual axle tree"—5 years.

To Jean Batiste Coeffet, of Charmont, for a wind instrument, he calls "ophimonoclude"—5 years.

To Louis Jung, of Paris, for a machine to cut screw-nuts, washers, &c.—5 years.

To Charles Louis Durand, of Paris, for an improved cotton twist, employed in weaving bobbin-nets—15 years.

To Japy fréres, of Baucourt, for a double cutting press—15 years.

To Quetresoltz de Marolles, of Versailles, for a corn machine for thrashing—5 years.

To Pierre Isider Rouen, of Paris, for a new lamp beak—5 years.

To Charles Francois Mullere, of Paris, for improvements in his desk for drawing—5 years.

To Pierre Louis Charbomeaux, of Versailles, for a new system of coaches—10 years.

To William Keen, of London, for improvements in steam engines—15 years.

To Pierre Fusz, of Isming, for improvements of his machine, he calls "lever carriage lock"—10 years.

To Pierre August Gluzel, of Paris, for a new fur hat—5 years.

To Barier, of Lavoult, for a machine, "pneumatic hydraulic"—15 years.

To De Barres du Molard, of Paris, for a system of bridges—15 years.

To Pierre Ramon, junr., of Bourdeaux, for a distilling apparatus—5 years.

To Simon Alleau, of St. Jean d'Angely, for improvements in the distilling apparatus—10 years.

To Jean Pierre Pragez, of Aix, for a distilling apparatus—10 years.

To Dufour, of Paris, for an elastic spring to put into hats—5 years.

To Rodolphi Walz, of Leipsic, for an apparatus for shower baths—5 years. [*Newton's Journ.*

[TO BE CONTINUED.]

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania;

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

JUNE, 1829.

On the Art of the Liquorist.

[Translated from the *Dictionnaire Technologique,* for the Technological Repository.]

The term *liquorist,* is given to the preparer of *liqueurs* for the table, and which are composed of alcohol, water, sugar, and different aromatic ingredients. Since the valuable discovery in distillation, made by Edward Adam, a total change of system has been effected in the manipulation of the distillers of brandy and other spirits; and the liquorist now assumes the title of *distillateur-liquorist,* because he is necessitated to re-distil brandy, in order to transform it into spirits fit for his purpose. Whereas, formerly, the distiller always furnished the rectified alcohol to the liquorist. We shall now proceed to give the necessary information, to enable persons to obtain excellent products.

The liquorist extracts the perfumes from the various aromatics which he employs: first, by infusion, and then by distillation. The liquor in which he infuses them, varies according to their nature; but it is the alcohol known in commerce, under the name of *thirty-six and a half* degrees*, which he employs; and either pure, or mixed with an equal measure of river water, or other pure water, when it is termed alcohol of eighteen degrees.

Infusions of fruits or rinds.—With a very sharp knife, he peels off the outside rinds, in thin morsels, in order that they may the more readily yield the essential oils which they contain. These are let fall into a glazed earthen vessel, containing alcohol of 36°, di-

* Of Beaume's Areometer, equal to about 0.8500 specific gravity.

luted with an equal volume of water, and which must, afterwards, be securely closed; but when he would employ the fruits themselves, he puts them into large bottles, made of white glass, and which must also be well closed. In either of these modes, he thus prepares the infusions of citrons, oranges, lemons, shaddocks, *bergamottes*, &c. These are left to infuse during six weeks, frequently shaking the vessels from time to time, and are finally distilled.

Infusions of seeds.—The aromatic seeds, after being previously bruised or pounded, must be put into large glass bottles, well closed, together with alcohol, diluted with an equal portion of water; they must be shook up from time to time, during the space of six weeks, and be then distilled. In this manner the seeds of fennel, anise, cloves, dill, &c. are prepared. But as the seeds of celery, and angelica, contain an essential oil, which is too acrid when prepared in the above manner; so they employ the stems of those plants instead thereof.

Infusions of aromatic woods.—These are either to be pounded, or to be cut into minute portions; and they add a few drops of water to them, whilst pounding them, to retain them the better under the pestle. These are to be infused and distilled, in the same manner as the seeds.

Solutions of aromatic resins.—Myrrh, aloes, storax, and others, which form the bases of elixirs, likewise enter, in small quantities, into the composition of certain *liqueurs*, when dissolved in pure alcohol of 36°. These solutions should not, however, be more than slightly charged therewith, lest they become too acrid.

It is easy to conceive that the warehouse of the liquorist should be furnished with proper shelves, &c., on which the vessels which contain the great number of various infusions he requires, should be placed always ready for use. Each of the vessels should bear a label, indicating the nature of the infusion which it contains; and also whether the infusion has been made with alcohol alone, with the diluted alcohol, or with water only, as is the case with flowers, before submitting them to distillation. When the maceration has been sufficiently prolonged, we proceed to a careful distillation. The products of each distillation must be likewise preserved in similar large and well closed bottles, and bear the name of *spirit*, as *spirit of citron*, *spirit of aniseed*, &c.

The liquorist who is anxious to manufacture excellent *liqueurs*, never adds the colouring materials to them, until six months has elapsed after their distillation. He suffers that time to elapse, in order that the perfumes may be well combined with the alcohol. If, nevertheless, he is obliged to employ them in a short time afterwards, as, in the course of a few days for instance, he then takes care to shake up the vessels more frequently every day, in order to hasten their combination.

On the composition of liqueurs.—The *liqueurs* are designated by different names, according to the manner in which they have been manufactured. They are thus termed *waters*, *creams*, or *oils*. The *waters* are those *liqueurs*, which do not present any viscosity to the

taste. The *creams*, or *oils*, appear to possess those properties, on account of an agreeable species of viscosity which they afford in the mouth. The same *liqueur* may be made to possess either the first quality or the second, at will, by merely changing the proportions of the perfumes, or other ingredients employed. An example or two will enable us to understand the difference.

Cedrat-water.—Three kilograms of white sugar are to be dissolved in eight litres of river water; then add two litres of *spirit of cedrat*, and one litre of *spirit of citron;* make the whole boil for a minute, and filter it, while hot, through a straining-bag (*chausse;*) receive the liquor into a vessel of earthenware, and change the vessel as soon as it no longer passes clear. When it becomes cold, put it into large bottles, and do not open them until a considerable time afterwards.

Oil or cream of cedrat.—Eight litres of river water, two litres of *spirit of cedrat*, and add as much sirop of sugar as will soften the *liqueur* to the necessary degree, to give it a clammy consistence; then agitate or stir it well with a *spatula*, to make the combination perfect, and put it into bottles, which must remain for a considerable length of time unopened. If the *liqueur* should become a little turbid, it must be filtered through paper, or better through a filter made of fustian, suspended in a funnel of tinned sheet iron, closed by a moveable cover.

We see, by these two examples, that the difference between the *waters* and the *oils*, consists in employing more or less sugar. When we use the sugar in its entire state, and but in small quantity, we form the *waters;* but when we employ it in the state of sirop, and increase the proportion of it, we obtain a viscous *liqueur*, and which appears oily both to the sight and taste.

Our limits will not permit us to give recipes for making all the kinds of *liqueurs;* but they may be found in several works which treat on the art of the liquorist; we shall merely give the leading outlines of this art.

The perfection of the liquorist's art, consists in his thoroughly studying the nature of the perfumes which he employs, and in making his mixtures thereof according to the proportions which are best fitted to develop the principal flavour which should predominate in the *liqueur*, but avoiding all acridity; and also in employing with prudence and good management, those other substances, which, without being distinguished by their peculiar tastes, are, nevertheless, necessary to strengthen that particular perfume which we have a view in employing. The *liquorist* ought, therefore, to possess a most delicate taste; he ought also to know, at least, as much of chemistry as should prevent him from hazarding the mixing of those substances together, which, by decomposing each other, would afford results the most contrary to those he is endeavouring to obtain. He ought, likewise, to thoroughly understand the principles and the practice of distillation, as well as to be able to prepare his spirits, and the plants, flowers, roots, woods, &c., and to extract their perfumes, and which he must employ every instant in his business.

The art of the *liquorist* is one of the most important applications of chemistry; and one, which those who are but little versed in this science, can have but small hopes of carrying to that degree of perfection of which it is susceptible. Before chemistry had made such progress, the *liquorist's* art was an empiric one, and every thing was done at hazard. Formerly, whenever any one fortunately happened to compose a *liqueur*, which pleased both the taste and smell, he was praised up to the skies; and every one endeavoured either to obtain his recipe, or to imitate the *liqueur*. Now, since we have studied the true methods of operating, we work with greater ease, and more economy; and obtain results which are more pleasing to the taste, as well as much more wholesome.

We shall now give the recipes for several new *liqueurs*, which have never before appeared in print; and are, indeed, the results of our own experiments. We are convinced, that by following the processes, excellent *liqueurs* may be made by infusion; and to which the properties, either of an oil or a cream, may be given with facility.

No. 1. *Baume des Moluques.*—We infuse for ten days, in a stone or glass vessel, capable of holding twenty kilogrammes of water, five kilogrammes of brandy, at eighteen degrees, two kilogrammes of white sugar, two kilogrammes of river water, fifteen grammes (four gros) of cinnamon, in powder, fifteen grammes (four gros) of cloves, powdered, and three grammes (forty-eight grains) of mace, bruised. The whole must be shaken, or stirred up, three times a day; and a brown colour is to be given to it by caramel (burned sugar.) At the end of the ten days it must be filtered, and put into closed bottles.

No. 2. *Larmes des veuves du Malabar.*—The same quantities of brandy, sugar, and water, as in No. 1; to which we add fifteen grammes (four gros) of powdered cinnamon, three grammes (forty-eight grains) of bruised cloves, and the same quantity of mace. This must be slightly coloured with caramel.

No. 3. *Les dèlices du Mandarin.*—Brandy, sugar, and river water, in the same proportion as in No. 1; and either add fifteen grammes (four gros) of starry aniseed (*badiani*) or of *ambrette* (*hibiscus abelmoschus, L.*) in powder; and also seven or eight grammes (two gros) of *carthamus*, or bastard saffron.

N. B. We must take care in giving a gold colour to this *liqueur* with the bastard saffron, as its smell resembles that of honey, which smell it may also communicate to the *liqueur*, and render it disagreeable.

No. 4. *Les soupirs de l'amour.*—Brandy, sugar, and rain water, in similar proportions with No. 1. But we perfume it with the essence of roses, of which we add a sufficient quantity to give it the required scent. A pale rose colour is given to it by the tincture of cochineal, as we shall describe below. It must be filtered when the sugar is dissolved; after which, it must be well stirred up five or six times, and then be put into well stopped bottles.

We can also make this *liqueur* without employing the essence of roses, as follows:—five kilogrammes of brandy, at eighteen degrees;

two kilogrammes of white sugar; of rose water, distilled in the manner hereafter described, a sufficient quantity to give it a fine perfume. If the *liqueur* should prove too weak, more brandy must be added to it, of thirty-six degrees; but if it be too strong, dilute it with rain water; and if it has not a sufficient consistence, add sirop to it.

The rose water which we recommend, is made in the following manner:—we place in the body of a still, a layer of rose leaves, then another of powdered kitchen salt, then another layer of rose leaves, and another of salt upon that; and so on, up to the neck of the still, observing that the last layer is a slight one of salt. We then fill the body with water, and proceed to distillation. The first distilled products are to be re-passed a second and a third time, upon new rose leaves, arranged as in the first distillation, with salt between the layers. After three distillations, the rose water will be perfect.

No. 5. *Crème de macarons.*—Brandy, sugar, and rain water as in No. 1; to which we add 245 grammes (demilivre) of bitter almonds, peeled and well bruised; cloves, cinnamon, and mace, also bruised, of each three grammes (forty-eight grains.) Or we may substitute for the bitter almonds, the kernels of peaches or apricots, should they be thought too acrid.

This *liqueur* is made of a purplish, or violet colour, with a decoction of litmus, to which is added prepared cochineal, to give it a fine tint.

No. 6. *Curacao.*—We put into a large bottle, nearly filled with alcohol, at thirty-four degrees of Baume (or thirty-six) the peels of six fine Portugal oranges, which are smooth skinned, and let them infuse for fifteen days. At the end of this time, we put into a large stone, or glass vessel, five kilogrammes of brandy, at eighteen degrees, two kilogrammes of white sugar, and two kilogrammes of river water. When the sugar is dissolved, we add a sufficient quantity of the above infusion of orange peels, to give it a predominant flavour; and we aromatize it with three grammes of fine cinnamon, and as much mace, both well bruised. Lastly, we throw into the *liqueur*, thirty-one grammes (one ounce) of Brazil wood, in powder. The whole is left in infusion ten days, being stirred three or four times a day. At the end of this time, we taste the *liqueur;* if it be too strong and sweet, we add more water to it; if too weak, we add alcohol, at 36°; and if it be not sweet enough, we put sirop to it. We also give it colour with caramel, when we would tinge it.

No. 7. *Extrait d'absinthe de Suisse.*—Many persons have inquired for the composition of this *liqueur;* we trust that we shall give them a gratification in communicating a recipe given us by the late Cadet Gassicourt, who brought it from Switzerland.

"The distillers of Geneva, Basle, Zurich, Neuchâtel, Berne, and Lausanne, make a great trade in an alcoholic *liqueur*, aromatized by wormwood and aniseed, and marking about twenty-four degrees of Baume's areometer. This *liqueur*, which is called *extract of wormwood*, is composed in the following manner:

Summits of the greater wormwood,			2 kilogrammes.
——— of the lesser ditto,			1
Angelica roots,	of each		0,122 grammes.
Calamus aromaticus,			
Seeds of the starry aniseed (*badiane,*)			0,061
Leaves of the dittany of Crete,			0,031
Alcohol, at 20 degrees,			18 kilogrammes.

"These substances are infused for eight days: they are then distilled over a gentle fire, and we draw off nine kilogrammes of spirit, to which we add eight grammes (two gros) of the essential oil of green aniseed. The nine kilogrammes which remain in the alembic, serve for the preparation of a vulnerary spirit."

Most of the manufacturers colour their extract of wormwood, either with the expressed juices of smallage, or of spinach. This colour is very fine at first, but the light destroys it. Nevertheless, as a green colour is pleasing amongst the *liqueurs* at table, such as those of wormwood, mint, emerald water, &c., so we indicate a process by which we can obtain all the tints of green, and which are, likewise, durable.

On colouring liqueurs.—We ordinarily colour *liqueurs* yellow, fawn colour, red, violet, or green. The object is to employ permanent colours, which shall not be prejudicial to health.

Yellow.—The *safranum*, or *carthamus tinctorius*, contains two colouring parts, yellow and red: the first, the yellow, is soluble in water only, and is that with which we are at present occupied. In order to tinge *liqueurs* yellow, we infuse the petals of this flower in them, in a greater or less quantity, as we would have the yellow lighter or deeper.

Fawn colour.—The caramel gives a fawn colour more or less deep. To prepare it, we take an iron ladle, which is very clean, and put into it powdered white sugar, and place it over a stove; the sugar melts, and must be constantly stirred until it takes a perfectly equal brown colour; but we must take great care that it is not burnt. When it has attained the desired colour, we must throw water into it, and stir it up well; it will dissolve entirely, and yield a colour more or less deep, as more or less of it is employed.

Red.—Cochineal affords all the shades of red, accordingly as it is used in greater or less quantities; but the process for preparing it is always the same. We bruise the cochineal in a mortar, adding to it a sixth part of alum in powder: when these two substances are well pulverized, we pour boiling water upon them, and mix them well together with the pestle; we throw this colour into the *liqueur*, after previously passing it through a filter.

Violet.—Litmus yields a violet colour; we reduce the lumps of this material to a subtle powder, in a mortar, and pour boiling water upon it: we add this mixture to the *liqueur*, until it is coloured to the requisite degree, and finally filter it.

Blue and green.—Indigo dissolved in the sulphuric acid, affords a permanent blue colour. We take indigo in powder, and grind it up with a small quantity of water in a glass mortar, with a pestle

of the same material; on this we pour, from time to time, a little concentrated sulphuric acid, at 66°, or until the indigo appears to be entirely dissolved. We then add to the solution, carbonate of lime in powder, which neutralizes the sulphuric acid, forming with it sulphate of lime, which precipitates. We then treat the mixture with alcohol, which becomes charged with the blue colouring matter of the indigo. After filtering it and mixing it with the yellow of carthamus, we obtain all the varieties of green which we can possibly desire. This preparation is not injurious to the health, nor does it change the flavours of the *liqueurs* which are coloured by it. The confectioners use it also to tinge their green sweetmeats with.

The liquorist also makes the artificial wines, or ratafias, in which he employs all kinds of fruit, such as oranges, peaches, apricots, cherries, raspberries, strawberries, mulberries, &c. He takes these fruits, when they are perfectly ripe, and expresses their juices, which he suffers to rest for twenty-four hours, and then passes it through a linen cloth. In each *litre* of juice, he dissolves 245 grammes (eight ounces) of white sugar, and then adds alcohol of 36°, until it has sufficient strength. He leaves the whole to macerate during fifteen days; filters it, and puts it up into bottles. These wines, or ratifias, were greatly used formerly.

Many liquorists, also, prepare the waters for the use of the toilette; but these more properly belong to the art of the perfumer. L.

On the Mordants used in Dying, Calico Printing, &c.

[Translated from the *Dictionnaire Technologique,* for the Technological Repository.]

THIS term is used in many of the arts, to designate the agglutinating substances; which cause, by their application to different surfaces, the adherence of certain bodies to them. This is the term which is given in the art of carving and gilding, to the kind of varnish, or size, which serves to cause the leaves of gold or silver, to adhere to the work. In other arts, on the contrary, they call *mordants* the acid agents, by the aid of which they attack or corrode the surfaces of metals, in order to clean them. But in dying and calico printing, they attribute to the same word another meaning. It is chiefly used to describe those bodies which possess the double property of intimately combining with the organic fibres of the materials to be dyed or printed, and the colouring matters, from whence there results a triple combination, the mordant serving as the common bond of union between the colouring materials employed, and the tissue; so that their union is more intimate, and the dyes are, consequently, less perishable.

Such is the use of the mordants which form one of the principal bases of the arts of dying and calico printing. We shall now enter into farther particulars, by which we shall render their importance better understood.

In order to perfectly appreciate the utility of mordants, and their true functions, we must premise, that the colouring materials generally contain principles *sui generis*, and which possess particular affinities. Their distinctive characters in general, are, that they are neither acid nor alkaline; and yet, nevertheless, have the power of combining with certain bodies, and more particularly with their bases, and receive from each, modifications in their colour, their solubility, and their changeability. The pure organic colouring materials possess a very energetic affinity for certain bodies, a weak one for others, and nearly none at all for some. Amongst these primitive materials, some are soluble in pure water, whilst others can only be employed through the agency of particular substances. We may then conceive, after what has been stated, that amongst them all, a colouring substance may possess a certain affinity for the organic fibres, so as to be fixed or dyed with the mediation of mordants; and also that it may be insoluble in water; and, in fact, this is the case with the colouring matter of carthamus, annatto, and indigo. The two first are soluble in alkalies. It is sufficient, therefore, in applying them to dye cloth, to make a solution of them in an alkalized water, to plunge the cloth to be dyed into it; and to precipitate the dying material, by saturating the alkali in the solution, by means of an acid. The colouring matter, at the moment when it is separated from its solvent, is in a state of great division; and is brought into contact with the organic fibres, with which it has a certain affinity. It is thus intimately united with them; and, as it is naturally insoluble in water, or, as we may say, has no affinity for this vehicle, so any subsequent washings will not discharge the dye. It is not exactly the same with indigo, as its solubility in the dying bath does not depend upon a similar cause, but upon a change in its constituent principles. It is, however, certain, that after having been subjected to this modification, it becomes soluble in the alkalies; and when the cloths are plunged into a bath, impregnated with this solution, and are exposed to the air, the dying matter at once resumes its colour, and its original insolubility; and which subsequent washings cannot deprive of more than the superabundant portions remaining after the combination is effected; and which portions were merely deposited upon the cloth.

Thus we see, that it may happen, that the insoluble colouring matters which exist, together with those which possess more or less solubility, may not possess such an affinity for the organic fibres, as that the combination formed between them should be firm; but that water has an affinity for the colouring matter which balances, and frequently exceeds, that which it has for the cloth.

In this case, the dyers are obliged to have recourse to intermediate bodies, which may add their proper affinity for the colouring matters, to that which they possess for the organic molecules of the cloth; and thus augment by this double action, the intimacy and the stability of the combination. These are the intermediate bodies which have received, as we have before mentioned, the name of *mordants*.

The mordants are, in general, taken from amongst the bases, and the metallic oxides, and it would appear, at the first glance, that there exists a great number of them; but when we see that they must combine the double condition of possessing a strong affinity, both for the colouring matters, and for the organic fibres; and if, above all, we reflect that the insoluble bases are few, which possess the power of forming insoluble combinations, we shall perceive that their number is singularly limited. We know, in fact, that lime and magnesia, for example, possess a great affinity for colouring matters, and are capable of forming insoluble combinations with them; and they are generally employed as mordants, because they likewise possess an affinity for the organic fibres of the cloth.

Experience has shown, that of all the bases, those which succeed best as mordants, are alumine, tin, and the oxides of iron; and, also, that as the two first are naturally white, so they are the only ones which are fit to be employed when we would preserve the dying material of its original colour. On the contrary, if the mordant were coloured, we may conceive that there will, necessarily, be produced a colour entirely different from the primitive one.

If, as we have above said, the mordant forms a true combination with the cloth to be dyed, it results that the application of it should also be made under those circumstances which are the most capable of favouring the combination; and this, in fact, is daily practised in the dye-houses. We shall now enter into some details in this respect.

In order that a combination may be properly effected, it is in general necessary, not only that the bodies which are to be brought into contact should be in a state of liberty, or, at least, as nearly in that state as possible, but it is also known that the combination is best effected when the molecules are in the greatest state of division. As the mordants which act so as to combine with the tissue, are, as we have before said, insoluble by themselves, so we are obliged, in order to divide their molecules, to dissolve them in an appropriate vehicle: but this solvent also necessarily possesses, on its own account, an affinity for the mordant, which becomes an obstacle to its union with the tissue. And thus we must choose amongst the solvents, that whose attraction for the mordant is the weakest: and, as of all the acids which we can employ to dissolve alumine, for instance, vinegar is that which is retained with the least energy; we, therefore, generally substitute the acetate of alumine in place of alum, because the acetic acid abandons the alumine with such facility, that a mere elevation of temperature is sufficient to effect the separation of these two bodies. Before the substitution of the acetate, we used alum only; but the true reason was never known, why the dyers always gave the preference to Roman alum, and regarded it as being the most pure; and it is only within these few years that it has been known to what this preference was owing, as it had, for a long time, been improperly attributed to prejudice. M. D'Arcet was the first to perceive that this alum was not of a similar composition with other kinds, and that the greater part of it was cubic

alum; that is to say, that it contained an excess of base when compared with the ordinary alums. But the sulphuric acid can take up an excess of the base, and more than is sufficient for its saturization, but which it readily parts with; and when we heat a solution of cubic alum, we find that this superabundance of alumine separates, some in the state of a sub-sulphate, and some in the form of pure alumine, long before it has attained the boiling point. Nevertheless, we could not detect this difference, because the Roman alum, in its ordinary state, is soiled by a peroxide of iron, which clouds and obscures the solution, so that we cannot, in consequence thereof, perceive this precipitate of alumine and the sub-sulphate; and when we filter the liquid in order to crystallize it anew, we merely obtain the ordinary octahedral alum; we must, therefore, conclude, in short, that the preference in favour of Roman alum, has no real foundation; and that there exists no other difference between it and other alums, than what may result from their being more or less pure.

We will here mention an anecdote, which it may not be useless to quote in this place, in order to show how great the prejudice is against making any change in the processes employed in the arts. During the time when France was master of Rome, one of our most skilful chemists was sent there to inspect their different manufactures, and to compare them with ours. One of the chief manufactures, was this of alum; but he found that the construction of their furnaces was so bad, that their vast caldrons could only be heated at the bottom, and could not be made to boil. He strongly advised them to build them upon another and better plan, but in vain, as they were determined to follow the wise doctrine of adhering to the old established practice! Had the manufacturers followed the advice he gave them, they might have always produced the octahedral alum; as, according to the experiments made by M. D'Arcet, he always found that the cubic alum became decomposed at a temperature of from 40 to 45 degrees.

At one time the Roman alum was exceedingly scarce in France, and it therefore occasioned us to take considerable pains to purify that of our own manufacture, because we clearly perceived, as we have above stated, that its particular state was the only cause to which we could attribute the different effects obtained from it; but, as we also wished to procure an alum which should be perfectly free from any admixture of iron, which is by no means the case with the Roman alum, so we were led, according to the advice of M. D'Arcet, to add to the bath, at the moment of aluming, a little alkali. In fact, we thus produce the cubic alum, by diminishing the proportion of the acid in thus saturating a part of it.

The two principal conditions of a great division of the molecules, and their state of liberty, are fulfilled by this mordant, and its operation is easily effected; but it is to be observed, that the combination which it forms, results from a play of affinities between the solvent and the material of the cloth, which produces a species of division proportioned to the mass of the solvent. Thus, the cloth retains more of the mordant when the solution is most concentrated;

that is to say, when the insoluble base is least defended by the greater mass of the vehicle; and we found an important part of the process of dying, upon this observation. If we impregnate, for example, different parts of the same piece of cloth, with the same mordant, but at various degrees of concentration, we obtain, on plunging it into the dye-bath, a fixation of the colouring matter the more intense, as the mordant was the more concentrated. And thus, accordingly as the acetate of alumine is more or less concentrated in maddering, we produce all the shades, from the deepest red to the lightest rose colour; and with the acetate of iron and madder, all the tints from black to a light violet.

[TO BE CONTINUED.]

On the best method of Warming and Ventilating Houses and other Buildings. By MR. CHARLES SYLVESTER.

[From the Quarterly Journal of Science, Literature, and the Arts.]

[CONCLUDED FROM PAGE 315.]

NOTHING can be more obvious, than the decided advantage which this stove possesses over all others, and nothing remained for its improvement, but to give its different parts their proper proportions, and to vary its construction, so as to admit of its easy management in domestic use. By the former improvement, a larger quantity of air is admitted in proportion to the fuel consumed, and, of course, at a lower temperature. The advantages which result from this improvement, will be obvious. The ventilation of the rooms warmed by it, is much more complete, from a greater quantity of air being admitted; the temperature is more uniform, from the air being more dispersed; and, lastly, from the air being heated by a greater surface at a lower temperature, the apparatus is not in the least degree injured by the fire, and hence there does not appear to be any limit to its durability.

Nothing can be more vague and uncertain, than the opinions which have been formed of the different apparatus used for warming rooms by heated air. It has, in consequence, appeared to me a desideratum in inquiries of this nature, to be able to ascertain the power and merits of a stove, as we do those of an engine. For this purpose, my first object was to get an instrument capable of measuring the velocity of currents. After trying a variety of methods, I have found one, with which I am perfectly satisfied. It consists of a very light brass wheel, in the form of that for the first motion of a smoke-jack. An endless screw upon the same axis, gives motion to a wheel of fifty teeth, on the axis of which is an index, which is watched by the eye, when the instrument is exposed to the current. The wheel acted on by the current, is about two and a half inches in diameter, and the vanes, or sails, are eight in number, and fill up the whole circle, when their faces are parallel to the plane of their

motion, and they are adjusted to an angle of 45°. Under these circumstances, I have found that fifty revolutions of the first motion take place, while the current causing those revolutions moves through forty-six feet.

In order to ascertain the power and merits of a stove, I generally take a period of twelve hours, beginning with a good fire, and leaving off with the same. During this time, the velocity and temperature in the main warm air-flue, should be taken every half hour, and then the average of each taken, keeping an account of the coal consumed in the same time. The temperature of the outer air being also known, the excess of the average temperature above the atmosphere, is the datum required.

From the average velocity, the number of cubic feet of air passing through the flue in the twelve hours, may be known.

Put A = The number of pounds of air heated in twelve hours, allowing 14 cubic feet of air to 1 lb.

T = The excess of temperature above that of the atmosphere.

W = The weight in pounds of coal consumed in the same time.

E = The effect of the stove, which, in stoves of all sizes on the same construction, should be generally a constant quantity: since A the quantity, and T the excess of temperature, are advantages to be produced by W the weight of coal.

E, the effect will be directly as A and T, and inversely as W. Therefore, $E = \frac{A\,T}{W}$.

To give an example in practice:—a stove which is capable of warming 100,000 cubic feet of space to 60° in the coldest season, when placed at the depth of nine feet below the level, at which the warm air is discharged, will furnish about 45 cubic feet every second, raised 60° above the temperature of the atmosphere. To keep up this current and excess of temperature for twelve hours, it will consume not more than three bushels of coals, or 252 lbs. In this case, 49 cubic feet of air in each second, will be 1,944,000 in twelve hours, equal to 138,857 lbs. Hence, $E = \frac{138,857 + 60}{252} = 32,930$.

This number may be taken as a constant quantity, expressive of the power of any stove; but it also expresses the weight of air in pounds, which one pound of Newcastle coal heats one degree of Fahrenheit's thermometer.

This number will not be strictly a constant quantity, as small stoves will not act quite to the same advantage as larger ones; and local and other circumstances will, in some degree, alter the result of experiments made in the manner above stated. This is more especially the case, when the admission of cold air and the discharge of foul air, are in any degree influenced by the wind.

The cold air is generally brought directly from the atmosphere; and, therefore, as its progress along this channel is affected by the wind, a greater or less quantity will pass through the stove. If the

air be deficient, less heat is carried off from the heating surface, and a greater proportion goes up the chimney; on the contrary, when the wind blows into the cold air-flue, the two forces conspire, more air is admitted, more heat is carried off with the air, and, of course, less is wasted up the smoke-flue.

In all situations where it is practicable, I use an effectual means of regulating the admission of cold, and the escape of foul air, by placing at the commencement and termination of these apertures, a turn-cap, or cowl, in which the vanes are so fixed as to let the wind blow into the one, and assist the escape of air from the other. Although this contrivance will always prevent a counter current, which, without its use, is sometimes the case, it does not prevent unequal quantities of air from entering, according to the strength of the wind. This is not found in practice to be a great inconvenience, for, during the most perfect calm, the air admitted by the power of the stove alone, is sufficient for every purpose of warmth and ventilation: whilst, with a tolerable fire in the stove, when the wind is considerable, the air comes into the rooms at a higher temperature than the rooms require, which is at least erring on the desirable side. If the quantity of air admitted under all states of the wind, were required to be uniform, the aperture in the turn-cap for cold air, might contain a self-adjustment, by the action of which its area would always be in the inverse ratio of the velocity of the wind; by which means equal quantities of air would always be admitted in equal times.

The turn-cap for the escape of foul air, is placed at the top of the building, and is made common to the roof. Under this arrangement, all the rooms into which the warm air is admitted, have each a foul-air flue terminating in the cavity of the roof.

The contents of all the foul-air flues, are, therefore, ultimately discharged at the turn-cap. This arrangement is adopted at the Derbyshire General Infirmary, and at the Wakefield Lunatic Asylum. In the summer season, when the stove is not in action, the ventilation will depend on the wind, which, at some periods, may not be adequate to that change of air required in hospitals. In such cases, I have adopted an additional means of ventilation. Instead of making the foul-air turn-cap common to the roof, I have placed it at the top of a cylindrical cavity, built in the roof. Into this cavity, I bring all the foul-air flues, which, also, in this case, may be smoke-flues, if constructed with brick. I also connect with the same cavity, the stove chimney, and, if possible, all the other smoke-flues in the building. By this means, it may be expected that some degree of rarefaction in the cylindrical cavity in the roof, will be constantly going on, and that hence a perpetual current will be established from every room towards the general outlet. It would be difficult to adapt such an arrangement to old buildings, without great alteration in the roof. But it would be easily introduced into new houses. The advantages derived from it in ordinary dwellings, would be very great. In the first place, there could not be an instance of a smoky chimney; in the next, a down current in an un-

occupied chimney, could not occur, and, therefore, the passage of the smoke of one chimney down another, would always be prevented; and lastly, by having only one outlet for smoke in every house, and that an object which may be made ornamental, we should ultimately get rid of the great deformity which arises from the present appearance of chimnies in buildings.

In all situations where it is practicable to make a cold-air flue, of considerable length under ground, the advantage is well worth securing. I have found by experience, that a cold air-flue of 50 yards in length, is capable of cooling the air in summer, to about an arithmetical mean, between the temperature of the air and the earth, and a similar advantage is produced by the earth warming the air in the winter season. The shape of the cold-air flue should be such as to present the greatest possible surface; the very contrary being essential to the best construction of flues for the warm air.

These facts will successfully lead to the means of cooling buildings in the tropical climates, and of warming the air when the winter's cold is much below the temperature of the earth.

On the Value of the Evidence from the Animal Kingdom, tending to prove that the Arctic Regions formerly enjoyed a milder Climate than at present. By the Rev. John Fleming, D. D. F. R. S. E.

It was long a favourite opinion among naturalists, that all the species of animals or vegetables, which the omnipotent Creator ever called into being, still remain the inhabitants of this globe, independent of the dangers to which they have been exposed, or the changes which have taken place in their geographical distribution. The difficulties which attended the acknowledgment of this opinion, arising from the number of singular forms found imbedded in the regular strata, or distributed among the loose materials on the surface of the earth—forms indicating species which the neighbouring districts did not possess—were conceived to be in a great measure removed, by the supposition, that unknown regions might yet exhibit living examples, in addition to many species of which the naturalist had obtained no information. In proportion, however, as the progress of geography extended our acquaintance with distant regions, and failed to furnish the requisite examples, the opinions of naturalists experienced a corresponding change. The ancient creed was at length abandoned; and no one, acquainted with the subject, refused to acknowledge, that in the earth were preserved the relics of numerous species which have no longer a place among the living on this globe.

The characters of the extinct species, after this change in public opinion, presented to the philosophical observer, an extensive field of research and speculation. Prevented now from expending his resources, in seeking out the dwellings of animals which no longer

exist, his attention was directed to the characters of those extinct species, the relics of which the strata had preserved, with the view of tracing their relations with the living tribes. The bones of the mammoth, occurring in the loose strata, were speedily identified with those of an elephant. The shells and corals of the older strata were exhibited, as resembling the productions of equatorial seas; while the impressions of vegetables, found in the shale of our coal-fields, were traced to be analogous to the productions of tropical forests. The conclusion seemed to be warranted, by an extended induction, that our region once enjoyed a tropical climate, at which time our rivers were swarming with alligators, our lakes with tortoises, and our seas with corals; when our caves were the haunts of bears and hyænas, and our forests the resort of the elephant and tiger. Nay, that in those northern regions, now suffering, during so great a part of the year, all the rigours of an iron winter, the climate was once so mild as to permit the residence of the rhinoceros and the elephant.

Imposing as these conclusions certainly appear, their validity might, with propriety, have been called in question, when naturalists, ceasing to rely on general appearances, examined more narrowly specific characters, and announced, as a result of their labours, that the extinct animals, though generically related to the tropical kinds, were yet to be viewed as *distinct species*. The argument in favour of a *change of climate*, which these fossil remains formerly seemed to furnish, now unsupported by observation, was found to rest entirely on analogy. Yet, in spite of this change of character, it is still relied on with confidence, as yielding support to hypothetical views; and few geologists of eminence could be mentioned, in whose writings it has ceased to occupy a prominent place. Some anxiously seek for proofs of a change of climate, on the supposition that our planet was once fluid by heat, and is still in the act of cooling; while others, guided by their notions of magnetism or electricity, are equally sanguine in their expectations of perceiving proofs of change.*

If it be admitted that the extinct animals are different *in species* from the existing kinds, and here, we presume, there is no difference of opinion, we shall be able to bring the subject into that form in which accurate conclusions may be obtained, or the value of those previously announced brought to a suitable test. Indeed, the whole argument in favour of a change of climate, seems to depend on the value of *analogy*, as an instrument of research. Supposing ourselves acquainted with the habits and distribution of one species of a genus, can we predicate, with any degree of safety, concerning the habits and distribution of the other species with which it is generically connected? Geologists ought to have investigated this preliminary question with care, before they commenced their specu-

* Professor Link in his Urwelt, or Antediluvian World; Kruger in his History of the Antediluvian World; and other modern writers on geology, oppose the opinion of Cuvier, and advocate the view discussed by Dr. Fleming in this memoir.—Editor.

lations. Instead, however, of acting with such caution, they have assumed that the question may be answered in the affirmative; or, rather, it does not appear that they were aware of any difficulty in the case, or conceived for a moment that their regulating principle might have no higher authority than a *petitio principii.*

Geologists, it is true, were countenanced, to a certain extent, in reposing confidence in *analogy* as their guide, by the authority of the most zealous, enlightened, and successful comparative anatomist the world ever possessed, Baron Cuvier. Successful in the employment of this instrument, in several instances, assisted, however, by numerous observations, this anatomist, under the influence of prejudices which few can avoid, has stated his confidence in the certainty of its deductions, with a boldness, which is the more astonishing, as it is equally at war with his own admissions and well known facts. "Any one who observes only the print of a cloven foot, may conclude that the animal which left this impression, ruminates; and this conclusion is quite as certain as any other in physics, or in moral philosophy."—*Recherches sur les Ossemens Fossiles*, i. 51. Observation had discovered many animals with cloven hoofs which ruminated; but, in such circumstances, would it be safe to infer that all cloven hoofed animals ruminate? Conceive ourselves contemplating the footmarks of a sheep and sow. Under the guidance of Cuvier's declarations, we would conclude that both ruminated,—an inference true in the one case, and false in the other. Observation here warns us against the employment of a guide so liable to deceive us. But this charge against analogy, may, perhaps, appear in greater strength, after the reader has perused the solution of the following questions.

1. *If two animals resemble each other in structure, will their habits be similar?*—If this question could be answered in the affirmative, it would greatly heighten the interest which is attached to the study of fossil remains, by giving to our observations an authority which at present they do not possess. The comparative anatomist has traced a considerable resemblance between the skeleton of the hippopotamus and the common ox. No analogy, in this case, would have led the inquirer to form even the slightest suspicions respecting the existence of those aquatic habits of the former animal, which constitute so singular a feature in its character. Let us place on a table the skeletons of the ermine, the polecat, and the otter, and the general resemblance of these to one another, would at once be admitted; and, confiding in our *analogies*, we might pronounce their habits to be similar. Observation, however, would convince us that these three species were different in their habits and propensities, though included by Linnæus in the genus Mustela. The common bear and arctic bear, exhibit equal resemblances of structure, and equal differences of habits. These facts, and multitudes of the same kind which might be produced, intimate the propriety of relying on analogy with caution, in all those cases to which our observation does not extend. The skeleton of the hippopotamus could not give any intimation of the diving powers of the animal, nor

would the bones of the feet of the otter lead to the supposition of its having webbed toes. Osteology, indeed, gives but very imperfect indications, even of external form, in many animals. Would the round caudal vertebræ of the seal, indicate the depressed tail of the animal, or the depressed bones of the face, in the whale, indicate the remarkable fulness of the outline of its head? We may agree with Cuvier in supposing that the mastodon had a proboscis like an elephant (to enable it to procure its food from the ground,) from the general resemblance of the two animals in structure, from the length of its legs, and the slight development of the toes; but when we remember the giraffe, with its head proportionally farther removed from the ground than the mastadon, able to provide food without a proboscis; and the hippopotamus and the dipper (*Cinclus aquaticus*,) which are excellent swimmers, though seemingly ill suited for the exercise, we shall view the conjecture in no other light than a probability, and not remarkably strong.

2. *If two animals resemble each other in external appearance, will their habits be similar?*—It is seldom, indeed, that two animals resemble each other, in all their organs, so very closely as to render it difficult for the attentive observer to discriminate species. Some modifications of form and structure usually occur in the one species, which cannot be perceived in the other, and which serve to influence its habits. But even in those cases where approximations of form are the closest, do we perceive a similarity of actions? If this were the case, the study of Natural History would be comparatively easy, as the field of observation would be reduced within accessible limits. The truths of zoology, however, forbid the indulgence of such expectations. The habits of each species must be studied as a separate subject of investigation, permitting analogy to assist, but in no case to guide us. The examples to justify this statement, may be taken from any one of the classes of the animal kingdom. The common shrew frequents old walls, and dry, grassy, banks; while the water shrew dwells on the margins of ditches, and swims and dives with ease. The common mouse, the pest of houses, itself improvident, seeks after the storehouses of men; while the field mouse frequents gardens and fields, and is not only a storing animal, but susceptible of torpidity. How different the solitary or pairing habits of the porpoise, from the gregarious wandering grampus. In birds, the same difference of habit accompanies generic resemblances. The rock dove builds its nest in caves, (and hence the plan of dovecots,) and delights to rest on a grassy bank; while the ring-dove frequents the forest, resting and breeding on trees. How dissimilar, in habit, the rook and the jack-daw, the heron and the bittern? Equally different the char, the sea-trout, and the common trout. Whether we contemplate *species*, in reference to their food, their haunts, their protection against foes, or the method of rearing their young, we find each exhibiting peculiarities, of which a knowledge of the habits of its congeners would not have given us the slightest

intimation.* But a third subject of inquiry yet remains to be investigated.

3. *If two animals resemble each other in form and structure, will their physical and geographical distribution be similar?*—Nearly the same anomalies present themselves, when considering animals in reference to their stations on the globe, as when viewing them in relation to their habits. Every species has its own appointed place, influenced in all cases by latitude, and even sometimes by longitude. The zebra delights to roam over the tropical plains, to which it is, in a great measure, restricted; while the horse can maintain existence, even throughout an Iceland winter. The buffalo, like the zebra, prefers a high temperature, and cannot thrive, even where the common ox prospers. The musk ox, on the other hand, though nearly resembling the buffalo, prefers the stinted herbage of the arctic regions, and is able, by its periodical migrations, to outlive a northern winter. The chacal (*Canis aureus*) inhabits Africa and the warmer parts of Asia; while the isatis (*Canis lagopus*) resides in the arctic regions. Species of the genus felis, likewise inhabit every climate, each limited in geographical distribution. The African hare and the polar hare, have their geographical distribution expressed in their trivial names. Ornithology might be called on to furnish examples equally illustrative of the question under discussion. The red grous is confined to the United Kingdom, in its geographical distribution, and is a bird which we may consider as peculiarly our own; while the ptarmigan has a range of dwelling, extending to the higher northern latitude of 74°.

The resources against the vicissitudes of the seasons, appear to exhibit equally remarkable differences according to the species. Thus, while the grous braves, unchanged in colour, the rigours of our winter, the ptarmigan assumes a white plumage: while the favourite redbreast spends his winter almost under our immediate protection, the nightingale betakes herself to a warmer climate. The yellow bunting remains with us throughout the year; the snow bunting only visits us in winter, and retires to spend the summer, and rear its young, on the rocks of Greenland.

From the preceding statements, which might have been extended to an almost indefinite length, the conclusion appears unavoidable, *that every species is controlled by its own peculiar laws*, and that no acquaintance with one species of a genus, however extensive and accurate, warrants us in predicating concerning the habits and distribution of any other species, even though very striking resemblances, in structure, and form, may prevail. What, then, is the amount of the argument, leading to the belief that the arctic regions once enjoyed a milder climate than they now possess, derived from the relics of animals found imbedded in the soil?—Remains of an elephant and of a rhinoceros, have been found in Siberia! These animals at present live under a warm climate; and when Siberia was peopled

* The reader will find some other illustrations of this subject, in my "Philosophy of Zoology," vol. ii. p. 88.

by such animals, its climate must have been much milder than in the present day!—If the relics of the elephant and rhinoceros, found in Siberia, belong to the *same species* which now dwell in equatorial regions, we must either suppose that they were transported to their present tomb, or, if they were the denizens of the country, that the climate of Siberia has greatly changed. In such circumstances, our conclusions would be supported by the truths of science, for, in reference to the *individuals of a species*, our knowledge of the ordinary habits and distribution of a few of these, qualifies us for judging respecting the remainder.* If, however, it shall be found that the relics of the elephant and rhinoceros of Siberia belong to *species different from those which now dwell in tropical forests*, our speculations must change their character, for the truths of zoology forbid us to reason concerning the *species of a genus*, in the same manner as we do with the *individuals of species;* and all our prejudices, associated with the *names* we use, must be dismissed from the mind.

Viewing, then, the Siberian elephant and rhinoceros, as different *in species* from those which we conceive peculiarly fitted to reside in a tropical climate, and the proof of this difference has been satisfactorily established, our conjectures respecting their original condition, must be conducted on widely different principles. If still unwilling to allow that these species ever resided in Siberia, but inclined to consider them as having been conveyed by some current of water from another and warmer region, we have to determine the locality of their residence at the very outset of our speculations. Now, these species no longer occur in a living state, in any region of the earth. Their former geographical distribution can be inferred only by the dispersion of their bones. These relics occur very frequently in the north of Europe, Asia, and America, in the higher latitudes, become scarcer as we proceed towards the south, *and do not occur within the geographical limits of the existing races.* It is vain, therefore, to have recourse to diluvian transportation, when we cannot point out the place from whence they may have been brought. If we admit that these extinct species lie buried in those very regions in which they formerly resided, and the whole circumstances of the case warrant the conclusion, what are the inferences which we may legitimately deduce? That as these species appeared to

* Sir Everard Home has, it is true, attempted to prove the identity of the Siberian and African rhinoceros, by considering the skull of a recent individual, brought by Mr. Campbell from Mashow, in South Africa (and which occupies a place in the museum of the London Missionary Society, and is recorded in the catalogue, p. 10.,) as having a perfect resemblance to those of the Siberian species.—*Phil. Trans.* 1822. In the twenty-second number of the Edinburgh Philosophical Journal, I intimated my suspicions of the accuracy of this opinion, founded on the great difference in the physical and geographical distribution of the two animals; and the inquiries which I made in London, in the spring of the following year, justified the view which had been adopted. Baron Cuvier's inquiries, about the same time, led to a similar conviction, that the celebrated London anatomist had been betrayed into error, by a too hasty and superficial examination of the specimen from Cafraria.—*See Cuvier, Oss. Foss.* iv. 493.

have lived in Siberia, they, consequently, must have possessed habits suited to their geographical distribution. This is reversing the ordinary notions on the subject; for, instead of suiting the climate to the species, we consider the species as suited to the climate. Nor are we left in doubt on the subject. The museum of nature has furnished us with a specimen to which an appeal can be made. The entire *carcass* of a Siberian elephant, or mammoth, as it is termed by the Russians, was found about twenty-two years ago, by Mr. Adams, (the bones of which form the skeleton in the Museum of the Imperial Academy at Petersburgh,) preserved in *ice*, near the mouth of the river Lena, on the shores of the Frozen Ocean. Did the skin present, externally, that thinness of hair, scaliness of surface, and naked appearance, which characterize the living elephants of the equatorial regions, or did its condition, as to hair, indicate an animal fitted, by its clothing, to reside in a cold climate? The covering was of three kinds:—*bristles* nearly black, much thicker than horse hair, and from twelve to sixteen inches in length;—*hair* of a reddish-brown colour, about four inches in length; and *wool* of the same colour as the hair, but only about an inch in length. Though much of the fur was lost, upwards of thirty pounds weight were gathered from the wet sand bank. Here, then, is a demonstration, that the Siberian elephant was not, from the abundance of its clothing, fitted for a warm country, but destined for a dwelling of an opposite character. In other words, that the Siberian elephant was fitted for braving the severity of a northern climate, and that at the period in which this individual died, there was freezing taking place in Siberia, much after the same manner as at present. To form an accurate conception of the Siberian elephant, or mammoth, we must not imagine an animal naked, like the African or Asiatic species, but enveloped in a shaggy, thick covering of fur, like the musk ox, impenetrable to rain or cold. The carcass of the Siberian rhinoceros, found on the banks of the Wilhoui, in 1770, by Pallas, gave similar indications of its hairy covering, being suitable to an arctic animal.

Perhaps there may be some readers, irritated at the overthrow of a favourite hypothesis, ready to offer the following objection. How could such animals, as the elephant and rhinoceros, find means of subsistence in the northern regions, which are so scantily supplied with herbage? There is no difficulty in conceiving the elephant capable of securing food, when we know that many of our largest quadrupeds at present people those regions; such, for example, as the musk ox, the moose deer, and the bison. The kind of food these ancient elephants employed, will, probably, never be ascertained, and we do not possess the means of forming even a feasible conjecture. We may know the kind of food the existing species prefer, but this yields no aid in determining the taste of the extinct species. Who is there acquainted with the gramineous character of the food of our fallow deer, stag, or roe, that would have assigned a lichen to the rein-deer?

Yet, reluctant to admit that Siberia was once peopled by elephants,

the reader may be disposed to ask, how could such animals outlive the winter? This question can only be answered by a reference to the history of animals in similar circumstances. The modern northern animals *migrate*, and we entertain little doubt that the Siberian elephant was equally disposed to the shifting of place, with the changes of the season.

Those who have been misled by the prejudices connected with the names *elephant* and *rhinoceros*, and, in consequence, have conceived the climate of Siberia to have been warm of old, to suit their supposed tropical animals, may yield to the force of the preceding arguments. Those, however, who imagine that our earth is red hot at the centre, as it was formerly at the surface,—that the period is not long passed by, since the crust became so cool as to allow *climate* to operate, will be inclined to retire from the untenable outpost, formerly occupied by the mammoth, to the more inaccessible strong holds of our lime quarries and coal pits. The strata, accompanying our coal metals, abound, say they, with the impressions of plants, which do not resemble the modern productions of our country. In order to find analogous forms, we must betake ourselves to warmer climes, and trace in the reeds, the palms, and the ferns, reared under a tropical sun, species resembling those relics which the older strata have preserved. And, if the fossil plants resemble tropical species, is not this a proof that our climate once resembled a tropical one? Two things very different are here confounded. Our fossil plants may resemble tropical plants; but if they are not *individuals* of *the same species*, the data which they furnish, however useful in tracing *affinities* of form or structure, furnish no clew whatever for determining geographical or physical *distribution*,—for it is with plants as with animals,—we may reason safely concerning the individuals of a species, but not concerning the habits and distribution of one species, from our knowledge of the characters of any other species of the genus to which it belongs. This country, cold as it is, may have had its palms, its cacti, and arborescent ferns, under a temperature similar to the present, due regard being had to species, not genera; for, at a comparatively recent period, and within the shade of the genealogical tree of our existing quadrupeds, Britain possessed an elephant, a rhinoceros, a hyæna, and a tiger.

[*Edin. New Philo. Journ.*

On the Natural Zero, according to Fahrenheit's Scale. By SIR GEORGE CAYLEY, Bart.

GENTLEMEN,—I send you the following considerations respecting the natural zero, which, though, perhaps, not perfectly conclusive, yet lead to a strong probability that the point of absolute privation of transferable caloric, as respects temperature, takes place at 448 degrees of Fahrenheit's scale, below his 0°, taking such degrees of this scale as range between 32° and 212°, as the standard, and

leaving the more refined inquiry as to their inequality, at present out of the question, though fully admitting that the zero I have named, must, hereafter, be regulated by the final result of that inquiry.

It appears that hydrogen gas at a mean temperature, is about 11,242 times lighter than water, and also that it can exist as a component part of water: hence, if it were mechanically condensed 448 times, when of the temperature of 32°, and supposing the particles to be as dense as water, there would still remain twenty-two fold more space unoccupied than occupied by them; hence, there would be no reason to suspect that their chemical relation to each other would be altered or deranged by this condensation. If 10,000 cubic inches of hydrogen gas, under mean atmospheric pressure, at a temperature of 32°, be elevated to the temperature of 212°, it will be expanded to 13,744 cubic inches, and all the experiments that have been made on the subject prove, that the expansion or contraction of all the gases, at a temperature of 32°, proceeds in perfect uniformity with the addition or privation of caloric, as measured by the thermometer, giving one 480th part of the whole bulk for each degree of Fahrenheit's scale. As this is the property of *all* the permanent gases, differing so widely as they do in their specific gravities, chemical qualities, and in their specific relation even to caloric itself, it seems to point out that in these aëriform fluids, when chemical attraction is in their own nature overcome, the expansion becomes the actual measure of the transferable caloric they contain, in that relation to heat we call temperature. In all these gases, if we could reduce the temperature 480° below 32°, all bulk, as connected with temperature, would cease; the particles would become contiguous, and deprived of all elasticity. The effect seems the measure of the cause; they originate and cease together. It may be argued against this theory, that steam, and the vapours of different fluids, as those of æther, alcohol, &c. are found to expand with equal uniformity by equal additions of temperature; but that each vapour has its own grade of elasticity: and hence that privation of caloric at which elasticity would cease, differs in each; chemical affinity between the particles in these cases, seems to exert, to a certain extent, a controlling power over caloric, and to modify its action. There is also a chemical combination of caloric with these fluid substances when they change to a state of vapour, which may materially affect their relation to transferable caloric: thus steam of 212° contains about 960° of caloric in chemical union, which does not affect its temperature. It depends upon the degree of pressure the water is exposed to, at what temperature it will rise into vapour, and commence this vast but imperceptible absorption of caloric. An additional pressure of three pounds per square inch, requiring about ten degrees more temperature before vaporization commences; hence, the power, whatever it be, by which the caloric enters into chemical union at 202°, is three pounds per square inch less forcible than at 212°, and six pounds less than at 222°, the whole power at 212° being equal to about fifteen pounds per square inch. The same ratio

exists as to this power in alcohol at 176°, and in æther at about 98°; in the former 38 degrees below the boiling point of water, and in the latter 128°. The expansive power arising from temperature in these cases, is evidently modified by the chemical affinities of these substances, as is rendered more evident by the circumstance that æther, the boiling point of which is so much below that of alcohol, freezes at —46°; whereas alcohol has been exposed to a temperature of —91° without freezing; and it rests on one authority only that it can be congealed at all, and that at a temperature of —110°. The striking circumstance with respect to the permanent gases, is, that they all agree as to the privation of temperature at which they would cease to be elastic. In their chemical formation, they seem to have embodied, permanently, as much caloric as neutralizes all attraction between their particles; and hence every addition of temperature from the natural zero, exhibits an expansion, or a force equivalent, if unrestrained, to generate expansion.

When we see that a few pounds pressure per square inch, has so much effect upon fluids when upon the point of rising into vapour, and contemplate the power which the particles of water exert when passing into the state of ice, so as even to split bomb-shells and cannon,—it seems very probable that in vapours, the effects of temperature are disturbed by counteracting forces, but that they have their full and undisturbed influence with perfect uniformity in the gases; and that all these point to 480° below 32°, or 448° below 0°, as their temperature of non-elasticity, or privation of all transferable caloric. There is an apparent contradiction to this hypothesis, in the circumstance that common air, when suddenly condensed seventy or eighty times, kindles the tinder called amadou, and fires gunpowder, &c.; but as the *capacity* of bodies for caloric, is in some inverse ratio of their density, much heat must be evolved by such a great increase of density; even a red heat is soon excited, by the condensation of soft iron under the hammer, to the extent of only 1-33d part of its bulk; and hence the fact is sufficiently accounted for, and is a case quite distinct from the caloric of temperature.

For the purpose of showing how small a proportion there is between the 448 degrees I have assumed as beyond the zero of Fahrenheit, and the absolute quantity of caloric embodied by some of the permanent gases, let two volumes of hydrogen gas be condensed 448 times, when of the temperature of 0° Fahr.; and as this is the proper proportion to generate water by combustion, supposing the particles to be each of the density of water, they would not be reduced to contact by this degree of condensation, but would have about sixteen times more space unoccupied than occupied: hence their chemical constitution would not be endangered, unless done too suddenly, so as to evolve caloric enough to ignite them. If this mixture were reduced to the temperature of 448° below 0°, the particles would then be in contact, and require no pressure to keep them so. We may, probably, assume, without much error, that from the reduced capacity as to caloric, as much of it will have escaped, from this cause, as would raise the temperature of the con-

densed mass, about 900 or 1000 degrees, and at the same time it will have lost by temperature, 448°: thus it might be said that 1448 degrees of heat are parted with by the gases, before they reach the natural zero; but it is obvious that the 448° only, are due to the account of *thermometrical temperature;* the other to a separate and distinct cause; viz. the diminution of capacity with respect to the caloric permanently embodied in these gases, by chemical combination. I shall quote from some experiments by Count Rumford, on the caloric generated by combustion, that one pound of hydrogen gas used as fuel, will raise 410 pounds of water from 32° to 212°, or 180°; (this estimate may not, perhaps, be very correct, but is sufficient for my purpose,) one pound of hydrogen gas requires eight pounds of oxygen gas to saturate it in the formation of steam, or water, by combustion; and hence, the whole caloric, which in the other instance was applied to 410 pounds of water, is, during the combustion, applied to the nine pounds of steam, or water, generated; and, therefore, its temperature considered as water, would be raised as much more than 180°, as 410 exceeds 9 ($4\frac{1}{9}^{\circ} \times 180$,) or 8200 of Fahrenheit's scale. If we knew with more accuracy the proportionate capacities of water, and of these gases, we might thus tolerably ascertain the actual ratio between that caloric which is chemically combined, and which seems to constitute the gaseous state, that which is lost by temperature, and that which is lost by reduced capacity. If we assume that, when these two gases are reduced to the contact of particles, by a temperature of —448, they have the same capacity for caloric as water, and that in the condensation, they have lost 1000 degrees by reduced capacity, we shall have the proportion of that which is moveable by both causes, when compared with that chemically combined and permanent, as 1448 to 8200, or nearly as 1 to 5.7. It is of great importance to ascertain the actual commencement of our scale of temperature, as it would lead to an accurate knowledge of what certain determinate quantities of caloric can effect, and it would become measurable, as the other constituents of compound bodies are. It is very probable that caloric will be found to combine in distinct doses, when it enters into those chemical unions not affecting temperature. If we assume —448 as the true zero, and assume 20° as a dose of caloric, the history of water in its relation to it, would stand thus: we should have twenty-four doses, or 480° of heat in ice at 32°; an addition of seven doses, or 140°, melts it to water; nine doses, or 180°, brings it to the boiling point, under atmospheric pressure, and forty-eight doses more, or 960°, generates steam at 212°. [*Phil. Mag.*

On the Nature of Light and Shadow, demonstrating that a Black Shadow can be rarefied, without Refraction, into all the Colours of the Rainbow. By JOSEPH READE, M. D.

I BEG leave to return you my thanks, for the correctness with which you have published my experiments on light,* and I hope the

* See Phil. Mag. vol. lxiii. p. 27, &c.

following novel experiment, may be favourably received by your scientific readers.

Experiment 1.—Having placed a table at about ten feet from a well lighted window, I placed on it a candle in a high candlestick. I now held a quire of white paper parallel to the table, and at right angles with the lighted candle: on holding this paper rather close to the blaze, two shadows were produced by means of a piece of coiled paper held immediately near the quire; the one next to the candle, was a bright orange, the other a bright blue. On turning the quire of paper towards the window, so as to cut off the light of the candle, this orange shadow changed to a perfect black; and on turning the quire of paper towards the candle, and excluding the light of the sun, the blue shadow likewise changed to a perfect black. Here I changed orange and blue colours into black, and *vice versa*, without any possibility of refraction. This experiment may be made by holding the paper behind the candle.

Experiment 2.—The former experiment was made with the paper between the candle and the window: I now held the paper close behind the candle, and perceived two shadows, the one orange, produced by the light of the window, rarefied by that of the candle; and the other blue, rarefied by that of the sun. On bringing these shadows on a straight line with the window, they overlapped, and produced one shadow of a perfect green colour. The orange shadow could be changed to a yellow, by bringing the shadow near to the blaze of the candle; or it may be made a brown, at a still greater distance: in like manner, the blue shadow could be changed to a perfect violet, by removing the paper to a certain distance from the blaze, and likewise to indigo. Thus we have all the colours of the rainbow, or spectrum, except red and purple: indeed, we have an extra colour, never to be found in the prism—brown.

Experiment 3.—About one o'clock, I perceived a large spot of light reflected by the sun on the side wall of my study, and it occurred to me that the colours might be different. Anxious to produce a red from a black shadow, having held the quire of white paper opposite this reflected light, and holding the coil of paper over it, I perceived two shadows, the one yellow, the other purple; and on holding a lighted candle near the purple, it changed to a lake, or perfect red. For the purpose of changing this red to a black, I stood between the paper and the side window, so as to intercept the light coming from the clouds, and only to admit the reflected sunshine to the paper; when the purple immediately changed to a black, the candle being previously removed. Thus, without any refraction, have we changed a black shadow, into all the variety of colours in the spectrum; for the most devoted admirers of the Newtonian doctrines, cannot argue that the atmosphere between the candle and the paper was a refracting medium, or that it stopped some and transmitted others, of the solar rays; all astronomers admitting that the rays coming from the sun are nearly parallel, on account of the great distance. I forgot to remark, that on bringing the candle to act on the purple shadow, a blue shadow was formed, as in the other

experiments; and, consequently, there were three shadows on the paper,—blue, lake, and yellow; the blue rarefied by the candle, the lake produced by the sunshine, and the other formed by the light of the window; for it is well known that every different light forms a separate shadow. As to the idea that black proceeds from the absorption of the seven rays of compound light, it is completely upset by these experiments; for we cannot suppose that the quire of white paper was at one moment an absorbing substance, and at the next a reflecting one; therefore, we must admit, contrary to the opinions of Boyle and Newton, that black is as much a reflected and independent colour, as blue, red, or any other colour of the seven. I shall not take up the reader's time, by quoting the opinions of Otto Guericke, Buffon, Bouguer, Melville, and others, on blue shadows; as they all accounted for blue shadows on the Newtonian theory, and never dreamt that a black shadow could be changed into all the colours of the rainbow, supposing that the fainter rays were stopped in the atmosphere, and the blue reflected. Some years ago, when writing the "Experimental Outlines," I had not attended to this part of my subject sufficiently, therefore could not account satisfactorily for the green which Buffon saw on the garden wall at sunset. This I now find proceeds from the overlapping of blue and yellow shadows, rarefied by the light of the sun, and light reflected from the clouds, or the cliff of the mountain. As these philosophers were involved in a labyrinth as intricate as that of Rosamond's Bower, and from which no clue could ever extricate them, I shall not attempt to follow them any further. [*Phil. Mag.*

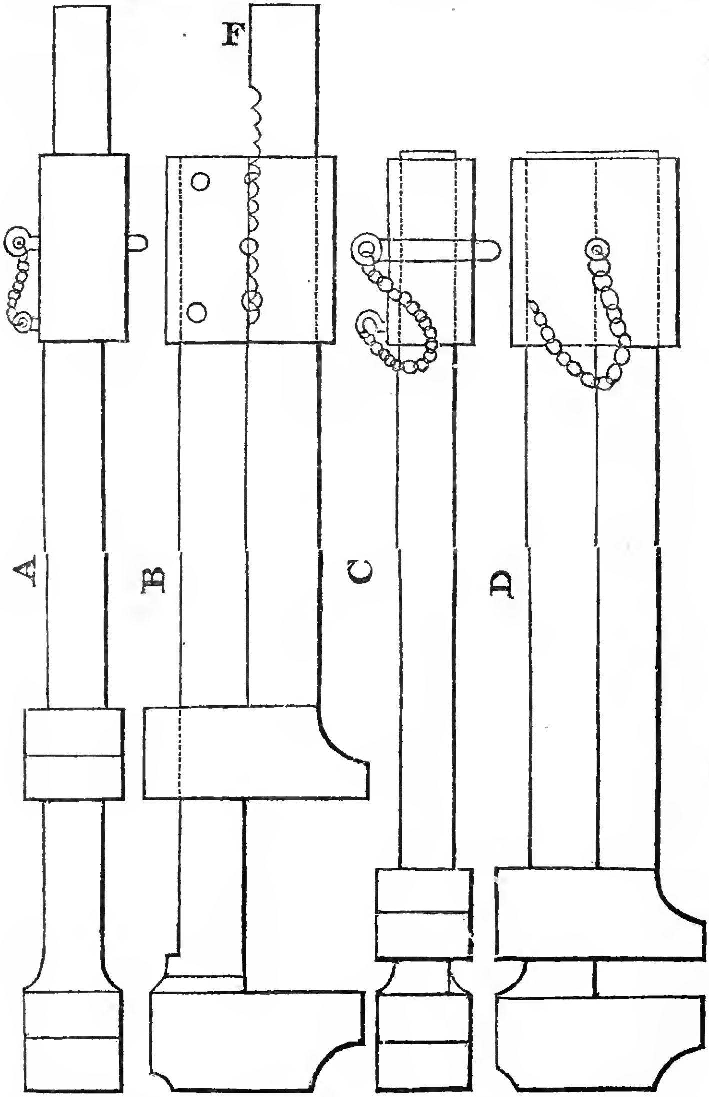
Description of a Shifting-Spanner, for Screw Nuts, intended as a substitute for the Screw-wrench, and also for the Wedge-Spanner.

For that well known instrument, the screw, or coach-wrench, a substitute was proposed and described two or three years since, in some of the English Journals. The sliding part of this wrench, or spanner, was secured by a wedge, instead of a screw. Its principal recommendation, was, the facility with which it could be made by any common smith. In a recent number of the *London Mechanics' Magazine*, another mode of fixing the slide is recommended, in which neither the screw nor wedge is employed; this plan is represented in the subjoined wood cut.

The figures A and B represent a back and side view, the spanner being open. A socket, or thimble, is formed and rivetted on to the fixed part, as represented at the upper end of B. Across the sliding part F, semicircular notches are filed, one close to the other, like saw teeth, and one, two, or three, similar notches are made across the fixed part B, opposite to which holes are drilled through the socket, or thimble; through these a round pin may be passed, which will secure the slide in its place, and its distance may thus be regulated with great precision. The pin may be attached to the socket,

by means of a small chain, and may be fixed and removed with the utmost facility.

The figures C and D, represent the spanner as closed, when the



two ends stand even. The jaws are still separated to a small distance, to allow of strengthening the fixed bar, by forging it in the bracket-like form seen in the drawing.

On the means of Propelling Boats on Canals. By Mr. David Gordon, *of London. Communicated by the Author, in a letter to the Editor of the Repertory of Patent Inventions.*

Sir,—Should you consider the following particulars of a voyage I lately made from London to Manchester, in a steam boat constructed on the plan for which I obtained a patent, (a copy of the specification of which you inserted in the 1st vol. of the present series of your work,) likely to prove of interest to the readers of the Repertory, you will, perhaps, allow them to be inserted in your ensuing number. If increased speed, certainty, and the saving of expenses, be objects to canal proprietors, I feel very confident that the present invention, if judiciously adopted, will prove of great importance to them.

The objections to steam boats on canals, have, hitherto, been the projections of the wheels, the injury done to the sides and bottom of the canal, by the agitation of the water, from the blow given to it by the paddles, and by the paddles occasionally striking and destroying what is called the puddling. In my boat, these are obviated by having the paddles near the stern, within the line of the bottom and sides of the boat, and completely enclosed, both under, and at the sides of the paddles, with a plate of sheet iron, which not only prevents any possible agitation of water from the paddles, but also protects the wheels from being injured by coming in contact with the bottom or sides of the canal, by striking against the locks or bridges, or by being struck in passing, (a very frequent occurrence) by the other boats in the canal.

That my steam boat would cause less injury to the sides of the canal than even any other boat displacing the same quantity of water, and propelled with equal rapidity, I expected, because the principal injury to canals arises from the wave which follows the boat, to fill up the hollow it leaves; and the paddles of my boat drawing a quantity of water from considerably before them, and discharging it behind, fills up that hollow. The water, in fact, behind my boat, instead of being in one following wave, is all broken, and makes 15 to 20 small waves.

In going to Manchester, my steam boat went from $2\frac{1}{2}$ to 3 miles per hour, and in returning, from 3 to 4 miles; and I am confident might be propelled from 4 to 5 miles per hour, without causing so great a wave as another boat going half a mile slower.

This would be a rate quite sufficient to induce passengers to adopt that mode of conveyance, especially to mechanics and their families, going from one manufacturing town to another. But it would soon be not alone the industrious and saving portion of the community, who would travel by the canals, because these pass through beautiful parts of the country where no roads do, and would, therefore, be adopted by parties of pleasure in the summer, if canal steam boats were once properly fitted up for passengers, and at all times by invalids, and those that were not in a hurry.

I estimate the saving of expense as follows:—A ten horse steam engine, placed in one long narrow boat, and occupying, with the other machinery, not one-third of the measurement tonnage, carrying passengers and light goods, and towing another boat, at the rate of 4 miles per hour, would not consume more than 1 cwt. of coals per hour, which, where coals are cheap, which is usually the case on canals, would not be more than from one-third to one-eighth of the present cost. In all the wide canals, both boats could go into the locks together, and thus lose no time in passing them. In this manner the trade might be carried on from London to Coventry, or Atherstone, as in all that long distance, there are only three locks where the two boats could not pass together.

I am your most obedient servant,

David Gordon.*

French Patent.

Brevet d'Invention, to MM. Braconnot *and* Simonin, *for the manufacture of a substance analogous to wax, called* ceromimeme, *proper for making Candles and Soap, and producing, in the process, Sulphate of Potash.*

This substance, which may be substituted in place of wax, for many purposes, but particularly for producing light, is extracted from all animal fats, by the following process:—

The fat, or suet, from which the concrete matter is desired to be extracted, is diluted with a variable quantity of volatile oil, commonly that of turpentine. The mixture, placed in cylindrical boxes, lined with felt, and whose sides and bottoms are pierced with numerous small holes, is submitted to a gradual and very strong pressure, which expresses the volatile oil mixed with it, and along with it the most fluid part of the fat employed; the solid substance remaining in the boxes, is then taken out, and boiled a long time with water, to remove the odour of the volatile oil. It is afterwards kept in fusion for some hours, along with animal charcoal, recently prepared, and then filtered while boiling hot, and left to cool. This substance is then of a brilliant white, semi-transparent, and brittle, and without taste or odour.

This substance, though very fit for producing light, cannot, however, be employed for that purpose in this state, on account of its too great fragility, which neither permits it to be moulded, or to be moved about; a sort of ductility and tenacity can be communicated to it by a slight contact with chlorine, or hydrochlorine (mu-

* The patent to which the above letter refers, was obtained as early as 1825. We have not by us the volume of the Repertory in which it appeared, but the letter gives a sufficient outline of the nature of the invention. The reason for inserting it, is, to exhibit the fact of the existence of such a plan, to those who have, recently, applied for patents from the United States, for a similar invention, as this has occurred in several instances.—Editor.

riatic acid:) a fifth part of bees' wax, mixed with it, produces the same effect. It is then readily applicable to use, and candles can be moulded from it, which are as agreeable in burning as those made with wax.

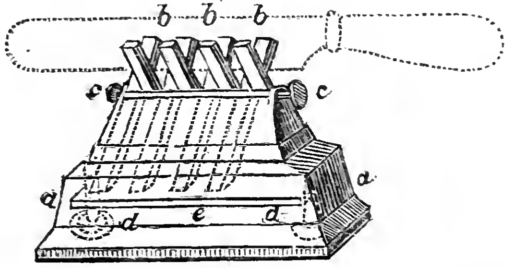
The oil expressed, or the more fluid part of the grease employed, containing, besides the volatile oil, which may be separated by distillation, a considerable quantity of the concrete matter, which it draws off and holds in solution, being purified and whitened by bone charcoal, is eminently fit for making excellent soap for the arts, and even for domestic use, its odour being weak, and not too disagreeable. This animal oil, first saponified by the potash of Vosges, is formed into a hard soap with a base of soda, by means of the sulphate of soda, which is of small value, and found abundantly in the saline waters of the departments.

This process has the advantage of affording to commerce sulphate of potash, sought for by manufacturers of alum.

ENGLISH PATENTS.

To FRANCIS WESTBY, *Cutler, for his invention of certain improved apparatus, to be used for the purpose of Whetting or Sharpening the Edges of the Blades of Knives, or other Cutting Instruments.* Enrolled July, 1828.

AN apparatus for sharpening edge tools, by means of two grooved steel cylinders, was the subject of a patent granted to J. Felton, in June, 1827. The invention now before us, is upon the same principle, but different in form. It consists of a box, containing several straight bars of steel, with file edges, which are fixed at acute angles, crossing each other; and the knife intended to be sharpened, being drawn to and fro with its edge downwards, touching the angles at which the steel bars meet, will become sharpened by the operation of filing.



The accompanying figure shows the apparatus in perspective; the dotted lines representing the parts within; *a*, *a*, is the box, or case, containing the steel bars *b*, *b*, *b*, which are placed alternately at opposite angles, crossing each other. These bars are held fast by the

screws *c, c,* which pass through the ends of the box, and bear up against the sides of the two outer bars, confining them all firmly in their places.

The edges of the steel bars are cut with fine grooves, extending lengthwise; and the knife introduced between the angles of the bars, being drawn to and fro, receives the operation of filing to a fine angular edge, which renders it thin and sharp.

In order to vary the angle of the steel bars, which will be sometimes necessary, according to the thickness of the knife, or other edge tool, required to be sharpened, the lower plate, or table *d,* on which these ends bear, must be raised or lowered. This may be done by turning the screws *d, d,* by which the moveable bottom, or plate *e,* is held up, and attached to the box.

As the file edges of the bars will wear away by use, they may be taken out of the box, and turned round, so that different edges may be presented at the angles, or their ends may be reversed.

Another contrivance of this kind for sharpening knives, has been invented by Messrs. Blake, of Sheffield. It consists of a series of these file edged bars, connected together merely by an axle passed through their centres, and may be set at any angle, and made fast by a screw. The contrivance is very simple, the cost but very trifling, and its use equally effective. EDITOR.

[*Newton's Journal.*

To LEMUEL WELLMAN WRIGHT, *Engineer, for an improvement or improvements in the construction of Wheel Carriages, and in the Machinery employed for Propelling, Drawing, or Moving Wheel Carriages.* Dated April 15, 1828.

THE principal object of this patent, is the application of compressed air to work machinery, by which carriages may be propelled.

The apparatus proposed for this purpose, is composed of two strong cylindrical cases, (apparently five or six feet long, and from twelve to sixteen inches broad,) with hemispherical terminations, for the reception of the compressed air, placed horizontally at the hinder part of the vehicle, below the level of the axle of the hind wheels; from which cases, pipes of communication pass to a third case of a similar form, fixed transversely behind them; from this, again, the compressed air passes through valves, to two cylinders, furnished with pistons like those of steam engines, and placed in a horizontal position; the piston rods of which act, by connecting rods, on cranks (at the opposite side of the same plane) formed on a horizontal axle, placed transversely, farther forward: from a wheel, or pulley, on which axle a band of leather, or of other proper materials, passes round another similar pulley, on the axle to which the hind wheels are fastened, and which, being made to revolve by the action of the cylinders, propel the carriage. The valves that admit

the compressed air to the cylinders, and convey it from them alternately, are worked by horizontal bars, that extend forward to rings, which surround eccentric wheels on the crank axle; and the air cases are filled through stop-cocks in their sides, either by being made to communicate with stationary reservoirs of compressed air, formed on a large scale, or with the forcing pumps, by which these are filled by the action of mill machinery, worked by a fall of water, the expansion of steam, or other convenient primary power.

To increase the force of the compressed air, the intermediate case, through which it passes from the others, is heated by tubes that proceed through it horizontally from a small furnace at the rear of the vehicle; and it is also mentioned afterwards, that the same effect may be produced by steam admitted into the working cylinders, along with the compressed air, from a small steam boiler fitted up in the ordinary manner; but, when this latter method is used, the intermediate air case will not be required.

The hinder wheels are represented of unusually large dimensions, and common horizontal springs, placed on their axle, support the hinder part of the carriage frame, which frame thence proceeds forward to the seat of the conductor in front; before this latter, a vertical shaft is placed, by means of which the course of the front wheels is directed in the following manner:—On the top of the shaft, a bevelled toothed-wheel is fixed horizontally, turned by another similar wheel that is worked by a *pair* of winches, according to the drawing; to the lower part of the same shaft, a pulley is fixed, round which a band, of any fit material, passes backwards to a similar pulley, on another shorter vertical shaft, at the bottom of which a drum, or pulley, is fixed, from which a band, or chain, extends at both sides obliquely to the different extremities of the front axle, close to the inner faces of the naves of the fore wheels, which are represented small enough to be turned round under the carriage frame; and, consequently, when the conductor turns the directing shaft either way, the connecting bands will draw the front axle obliquely in the same direction, and cause the carriage to move in the course required, in the ordinary manner.

The air engine, and carriage, are to be set to work, or be made to stop, by means used commonly for such purposes, which are so generally known, that the patentee has not thought it necessary to particularize them; and he only adds, on this head, that the carriage may be made to go slowly down hills, by having an air-pump fixed to it, to be worked by an eccentric wheel on the crank axle, which may be set in motion to fill the air cases, on such occasions.

Along the road, where carriages thus propelled are to run, large strong reservoirs of cast-iron are to be placed at regular intervals, which are to be filled with compressed air, by air-pumps, worked by any of the means before mentioned for the purpose, from which reservoirs the air cases of the carriages are to be replenished with compressed air, according as the carriages are brought up to their stations.

The seats for passengers on these vehicles, are represented, like

those of many stage coaches, to consist of a coach body of the usual construction, with an open hind body annexed to it, the latter of which is placed over the working machinery, and has appended behind it a small seat, at a lower elevation, for the man who attends the fire-place.

Towards the end of the specification, a rotary engine is described, which may be put in place of the working cylinders, first mentioned, and which consists of a flat cylindrical case, in which a cylinder of less dimensions turns round concentrically on an axle, that passes through the flat sides of the first, and is made air-tight in all its points of contact. From the central cylinder, two hinged flaps, or pistons, project at opposite sides, that closely fit the annular interval between it and the external case, and from the hinge of each of them, an arm projects at right angles, which, as the inner cylinder is impelled round, comes in contact with a roller on a pivot, attached to the case, that causes the flap to open out across the annular space, so as to meet the action of the compressed air that is admitted behind it by an entrance pipe, which forces it round until it passes the opening to the eduction pipe, that proceeds from the case at an angle of about 120 degrees from the former; it is subsequently pressed round into a cavity made for it in the face of the inner cylinder, by a curved inclined plane, inside the case, that extends to near the entrance pipe, and serves as a stop, or fulcrum, against which the compressed air may press while acting on the impelling flaps.

The patentee in concluding, very properly states, that in the apparatus described, he only claims the peculiar application of the parts to the purposes mentioned, or, more particularly, to the propelling carriages, by means of compressed air, having its force increased by the application of an elevated temperature; and he also mentions, that the vehicle may be used either for carrying passengers and goods, or for *drawing after it other carriages.*

Obs.—Some unaccountable fatality seems to attend the numerous attempts of the many individuals who have recently obtained patents for propelling carriages by engines, that has, hitherto, prevented their success, but as we think the object for which they are designed, to be very beneficial, we hope the present patentee will, in a great measure, accomplish it, by avoiding the errors of his predecessors, of some of which, from the last statement in the account of his invention, he appears to be duly sensible.

The idea of using compressed air for working machinery, originated with Mr. Medhurst, whose first patent for this object, in 1799, may be seen in our fourth volume, p. 406, second series; but, as Mr. Wright has improved on it, by increasing the force of the compressed air by heat, he, perhaps, may make it produce a more profitable effect than the original patentee has, whose first exhibitions that we witnessed, at the date of his patent, were as far from promising, as they have since been from performing.

Much advantage would arise from the great lightness of which Mr. Wright's apparatus is capable, if it could be made to perform

for an effectually useful distance; but of this, though we have great doubts, we hope a fair trial may be made to determine the point, esteeming the object to be extremely worthy of the experiment.

[*Repertory.*

To John Evans, *the younger, Paper Maker, for improvements in Steam Engines.* Dated January 15, 1828.

The steam engine described in the specification of this patent, is of the rotary kind, and is made to revolve by means of two cylinders, attached to a horizontal axle, one of which is fastened to it permanently, while the other is capable of a sliding motion along it, but is made to act on it by a rib that projects from the former, that enters into a longitudinal groove, cut in the part of the cylinder which surrounds the axle. These two cylinders are enclosed by a hollow cylindrical case of a sufficiently larger diameter, to leave a space all round between them, for the passage of a hinged piston, the breadth of which space is represented in the drawing to be about a tenth of the radius of the case. A diaphragm, or partition, is fixed in the case transversely, between the two cylinders, and circular lids are placed at their external ends, which come close to the internal circumference of the case, at their edges, but are so chambered off beyond them, as to retain a ring of hemp-stuffing, or gasket, all around, against each of which a deep metal ring is made to press by means of a flanch that projects from it, which is drawn by screws and nuts towards the flanch on the end of the extremity of the case next to which it is placed, the ends of the two internal cylinders being ground to fit the diaphragm and the two lids, so as to be steam-tight; and one of these cylinders being made to slide along the axle, the action of the screws on the flanches, besides closing in the hempen stuffing, presses also the lids against the external ends of the cylinders, and thereby forces their internal extremities against the opposite sides of the diaphragm, so as to prevent any steam from passing between them. To form a stop, or abutment, for the action of the steam in impelling the hinged piston, (that is attached to each of the internal cylinders, so as to occupy the section of the spaces between them and the external case,) a longitudinal opening of small breadth is made through the side of the case over each of the cylinders, enclosed by projecting flanches, into which openings, rectangular bars of brass are fitted, so as to come closely in contact with the internal cylinders. Outside the brass bars, hemp stuffing is placed, with iron plates of the shape of the openings beyond them, which are pressed towards the cylinders by several screws, that pass through a bar which is retained parallel to them at a due distance, by pieces that connect it with the sides of the external case.

Not far from these steam-tight stops, apertures are made through the case over each internal cylinder, for the admission of the steam,

and above them valves are fixed, in boxes in which sliding valves are worked, (so as to open and shut the two apertures alternately,) by rods that pass through stuffing boxes in their sides, to the different ends of a balance lever, whose centre of motion lies in the middle between them; and which is moved back and forwards in the direction of the valve-rods, by a connecting bar, that joins it to a ring, which surrounds an eccentric wheel attached to the axle of the engine. At the opposite side of the stops, pipes proceed from the spaces between each cylinder and the case to the condenser, which latter is not particularly described. There are no means mentioned by which the sides of the hinged piston may be kept steam-tight, or by which it may be opened or closed, and so little is said of it, that it is from the drawing alone we know that it is intended to be hinged; but notwithstanding this great imperfection, we can comprehend the peculiar mode of action of the engine, to consist in the steam first impelling one of the cylinders by its piston a certain portion of a circuit, and then passing off to force round the piston of the other internal cylinder, so as to complete the revolution, while, at the same instant, the steam that acted on the first cylinder, is permitted to proceed to the condenser, by its piston having passed the opening of the pipe of communication; and as one of the two pistons is always acted on by the steam, while the other is passing under the stop, or abutment, the revolving motion of the axle is made continuous; that is, supposing some contrivance to be added to the engine, for making the hinged pistons rise up again, after being depressed by the abutments, so as to occupy the space between the cylinder and the case, as they did previously. The patentee, besides what we have mentioned, describes a deep longitudinal cavity, which he calls "a sink, or well," made in each cylinder, from its surface to near its centre, immediately behind each of the hinged pistons, which is covered by them, only when they are pressed down by the abutments. These cavities are intended to increase the action of the steam, under the erroneous idea, that it will act alone on that side of them which is underneath the hinge of the pistons; and they appear to us to be not only useless, but injurious to the engine, in several particulars. [*Ib.*

To William Percival, *Veterinary Surgeon, for improvements in the construction and application of Shoes, without nails, to the feet of Horses and certain other Animals.* Dated January 19, 1828.

These improvements consist of additions to the common frog-bar horse-shoe, and of ligaments, or bands, by which it is to be fastened to the hoof of an animal.

The frog-bar shoe, is composed of the front portion of a common horse shoe, comprising about a third part of the whole, to the middle of which, a piece of iron in the shape of the letter Y is welded

by the lower extremity, so that its diverging parts pass out at each side, where the hinder extremities of the hoof terminate. To the end of each of these diverging parts, a double ring is fastened, in the improved patent shoe, and to the middle of the toe part at its outer edge, a flat narrow piece, (like the hasp of an outside box-lock) is jointed, which turns up over the front of the hoof about half its height, and has, at its upper part, two narrow staples placed successively, which serve to keep the two folds of the ligature separate, and in their proper positions, that are wound round the lower part of the hoof. This ligature is composed of strong hemp web, about three-quarters of an inch broad, as represented in the drawing, and is long enough to pass twice round the hoof; it is furnished with a buckle, and when applied to use, is first passed through the lower heel ring of the shoe at one side, then brought through the lower staple of the front hasp, and along the other side of the hoof to the opposite lower heel ring, and, after going through it, is brought back again through the upper staple of the clasp, to meet the buckle on its other extremity, by which it is fastened tightly at the side of the hoof. A second ligature of the same fabric is provided for the upper part of the hoof, and back part of the pastern, which is furnished with two flat narrow pads, one of which lies at the upper edge of the hoof in front, and the other at the hinder part of the pastern, just above the heel; this last ligature passes through the upper heel-ring of the shoe at one side, then goes round the back of the pastern, close above the heel, down to the opposite upper heel-ring, and finally comes over the upper edge of the hoof in front, to the buckle at the other extremity, by which it is fastened close to the hoof, in the same manner as the first ligature; in which position it prevents the shoe from moving forwards beyond the hoof, while the first ligature, in conjunction with the clasp in front, keeps it from being driven backwards out of its due position. Where the folds of the last described ligature cross each other above the heel-rings, a flat sliding loop of metal is passed over them at each side of the hoof, to keep them more steadily in their proper places.

A clause near the conclusion of the specification, states that the sort of shoes mentioned, may also be used for asses, and for mules, as well as for horses.

Obs.—As the patentee has not explained his reasons for preferring the frog-bar shoe, (which only covers part of the toe of a hoof,) for the basis of his improved shoes, to an entire shoe of the common form, which protects the whole hoof, we may be the better excused for not being able to comprehend what may be his inducement; and own we feel inclined to prefer the latter combination.

But still it appears to us, that a shoe even of this last kind, secured as the patentee directs, would be too liable to accidental displacement laterally, and, therefore, we would recommend the addition of hinged clasps to its sides, similar to the one directed to be placed in front, and that they be fastened on by the same ligatures.

Shoes of this description, can be carried by riders without inconvenience, and would frequently be very useful in situations where horses must be occasionally used at a distance from blacksmiths. [*Ib.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS GRANTED IN MARCH, 1829.

With Remarks and Exemplifications, by the Editor.

1. For a machine for *Grinding Paints*, called the "Trumpet Mouthed Paint Mill;" Samuel Cook, Mendon, Worcester county, Massachusetts, March 3.

This is altogether a very compact, neat, and simple machine, and one which appears likely to fulfil the intention of the inventor, in a very perfect manner. One of the mills, of the ordinary size, has been sent to the patent office as a model.

The grinding is effected between rubbing surfaces of cast-iron. The mill receives its name from the form of one of these pieces of cast-iron, which exactly resembles that of the mouth of a trumpet, or French horn. This piece is about six inches in diameter, turned quite smooth within, and fixed to a frame, so that the plane of its edge shall stand vertically. The paint to be ground, is conducted to the centre of this piece, by means of a funnel, or hopper, which terminates in that part of it which would be the commencement of the tube, were it a trumpet. Into this hollow trumpet piece is fitted another circular piece of cast-iron, of nearly the same diameter, and which is made to touch the former, excepting at the centre, and in the spaces left for the reception and conducting of the paint; these spaces consist of two twisting grooves about an inch wide and a quarter of an inch deep, extending from the centre, to within half an inch of the outer edge, that part being left perfectly smooth. This second plate is made to revolve by means of a wheel and pinion, and there is, upon its lower edge, a spring scraper to remove the paint as it is ground. By means of a hinge, uniting the frame work of the mill, the two plates can be very readily separated from each other, for the purpose of cleaning them; and a thumb screw and nut secures them when together, and regulates their pressure.

"The peculiar excellency of this machine, and the object of the exclusive claim, are, the shape of the plates, by which the friction, so far as respects the effect on the mill, wears them nearly the same at the less, as at the greater diameter."

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2. For a *Lamp*, and ingredients for burning therein; Isaiah Jennings, New York, March 3.

The ingredients proposed to be burned in this lamp, are, 1st, oil, mixed with spirits of turpentine, three parts of the former, and one of the latter; 2nd, rosin, or turpentine, mixed with oil, one part

rosin, or turpentine, and seven parts oil, or other grease; 3d, any kind of hard grease, mixed with oil, by heating them together, in sufficient quantities to bring it to a soft state.

The lamp to contain the oil, or composition to be burnt, is either a spherical, or other formed vessel of glass, with two perforations; one below, for the admission of the tubes upon which the wick is placed, and one above, for the flame and heated air to pass through. The lower opening may be an inch and a quarter in diameter; into this is fitted a perforated cork, through which passes a tube $\frac{3}{4}$ of an inch in diameter, capable of sliding, or screwing up or down, through the cork. This tube may reach to the centre of the spherical glass, or may be passed up so as to be even with the top opening, of $2\frac{1}{4}$ inches in diameter, and surmounted by an ordinary burner. The tube may be made of brass, and on it is to be slipped loosely, a circular, or tube wick, which shall stand even with its top. A second tube, formed of earthenware, soap-stone, or any other imperfect conductor of heat, is then dropped over the wick. This tube is perforated in many places, to allow the oil, &c. to pass readily to the wick, and extends up to the height of the brass tube. When the flame is to be increased, the inner tube is to be depressed, so as to stand below the top of the outer tube. There is no contrivance for raising the wick, the depression of the inner tube, it is affirmed, producing a similar effect.

"What I claim as my invention, is, a tube passing through the bottom of the lamp, to be raised and depressed by a screw, or otherwise; the method of placing the wick even with the top of the tube; the tubes, or noses, of materials that are called 'non-conductors' of heat; and the compound ingredients for burning in the lamps."

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3. For a machine for *Packing Cotton Bales, Tobacco Hogsheads, &c. &c.;* Tyre Jennings, Statesburg, South Carolina, March 3.

This press is worked by a long lever, the centre of which forces down a follower, under which the article to be pressed is placed. In the actual press, this lever is stated to be 67 feet long, and to project beyond the frame of the press, 30 feet on each side: these arms are to be operated upon alternately. Strong cross bars extend horizontally from one side of the frame of the press to the other, like the rounds of a ladder. The fulcra of the lever are formed by passing moveable pieces of timber between these bars, above the top of the lever, on each side of the shaft of the follower, alternately. These pieces may be placed nearer to the centre of the lever, as the pressure proceeds, and it becomes necessary to increase the power. The lever, from its great length, requires to be braced, or trussed, or its elasticity would interfere materially with its action.

The whole structure appears to us to be extremely inartificial. The constant removal of the cross timbers, on either side, as the follower ascends, or descends, requires too much manual labour, and that of a kind which it is inconvenient to perform, and which would

scarcely be resorted to excepting where slave labour was principally depended upon. The same principle, under a much more convenient arrangement, is known to mechanicians, as applied to the press. Within the cheeks of the two upright posts of the frame of a press, are fixed iron racks; and upon the lever there are catches which take into the teeth of these racks, so as alternately to form fulcra, as the arms of the lever are drawn down.

The patentee claims the whole machine, as described by him.

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4. For *Nail Hammers;* and others, with draw, or pene; Charles A. Strong, Chatham, Connecticut, March 3.

The whole specification is as follows:—"The hammers are to be made of cast-iron, and cast in moulds fitted for that purpose, in the usual form or manner of other castings, with the face of the hammer against a plate of iron, which hardens it. They are then ground on the face and polished on an emery wheel, in the usual manner."

"What I claim as new, and as my own invention in the above manufacture, is, making the hammer of cast-iron, and hardening the face against a plate of iron; and a projection of about one-fourth of an inch on the inside, around the eye, which gives great strength to the handle, and beauty to the shape."

"The great advantages of the manufacture in this way, are, that they are more beautiful, admit of a higher polish, and can be afforded cheaper than wrought iron ones, and are equally durable."

On the 31st of July, 1828, a patent issued to Thomas Jones of Glostonbury, Connecticut, for a similar object. In this specification, hammers are directed to be moulded as other articles are moulded for casting. To harden the face, a piece of iron weighing about a pound, is to be placed in the mould, and a smaller piece for hardening the claw. They are to be ground and polished, and are then ready for use. The perfect similarity of the two patents is apparent.

We are at a loss to know upon what ground the patentees rest their claim, as they have not stated it in their description. Cast-iron hammers have been made for various purposes, and, indeed, there are but few articles for which wrought iron and steel were formerly employed, which have not been imitated in cast-iron, as it can be made either hard, soft, or malleable, as may be desired. The term "chilled cast-iron," is familiar to machinists; cast-iron suddenly cooled by being cast in iron moulds, or against masses of cold iron placed in a mould of sand, is so called.

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5. For an improvement in the mode of *Grinding Steel Dies* used in the manufacture of metal buttons; Willard Robinson, Attleborough, Bristol county, Massachusetts, March 3.

"Dies for stamping buttons, are made of hardened steel of a cubical shape, one side of which being formed to the figure intended to be impressed, and to the shape intended to be given to the button,

This process has, heretofore, been effected with the use of the graver and lap; a mode slow of operation, and subject to inaccuracies. My improved method of making said dies, is simple, much more perfect, and more especially so, when a rim perpendicular to the face of the button is to be raised upon its edge."

After these preliminary remarks, the patentee states that the first steps in forming the die, are the same as those heretofore known; that is, the cubical block is fixed in a chuck in the lathe, with its face side sufficiently exposed to be turned nearly to the form intended, by means of the graver, after which the improved apparatus is to be employed for giving an accurate finish. This apparatus is called the "graduated button rod," which is made and used as follows:—

There is a rod of iron, steel, or other metal, about half an inch square, and from three inches to several feet in length. This rod has indentations made by a prick punch, on opposite sides of it throughout its whole length, and at small distances apart. One end of it is drilled to the depth of an inch, to receive a piece of copper, or other metal, called a *fit*, which, by the aid of emery and crocus, serves to grind and polish the die. A front centre, or head, capable of sliding upon the bar of the lathe, has a perforation, or mortise, through which the rod may pass, and sufficiently large to admit of the motion which it is to receive. By means of a steel point projecting upwards, and an adjusting screw through the top of this head, the rod may be confined so as to vibrate laterally, in consequence of the points taking into opposite prick punched holes; the distance from the set being regulated according to the concavity of the face of the die.

A rest, standing in front of the die, supports the end of the rod, containing the *fit*, and serves as a guide in moving it backwards and forwards.

There is a sort of hinge joint in the front head, to admit of raising the rod, to examine the die, without the necessity of altering its adjustments.

"Although my said improvement is intended principally to be used in the formation of steel dies, for stamping buttons, it may also be usefully applied to the purpose of grinding concave mirrors of glass, or metal, also for optical glasses."

Without intending to intimate that a suggestion like the foregoing would vitiate the patent, we will observe that the validity of these instruments is frequently endangered by the desire to claim as much as possible. The safe course in all cases, is, to claim no more than the essential features of the new machine, as applied to purposes with which the patentee is familiar. We have no doubt, that an arrangement something like that described, has been applied to various purposes in the lathe. The two large brass mirrors made for Dr. Hare, of Philadelphia, and used by him in his experiments on the radiation of heat, were, at the suggestion of the Editor, turned and ground to a true curvature, by tools fixed upon a rod, and vibrating like that used for grinding the dies as above described. These were made in the year 1819.

6. For an improvement in the mode of *Making Bricks, Tile, or other Clay ware;* James Wood, Haverstraw, Rockland county, New York, March 3.

(See specification.)

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7. For a *Machine for Grinding Clay and Sand together,* and making the same into brick, at one operation, without the application of water; Alfred Cushman, Sumner, Oxford county, Maine, March 3.

The description of this machine is not given with sufficient clearness, nor its parts represented in the drawing with sufficient distinctness, to enable us fully to understand it; we must, therefore, explain it in a very general way.*

A vertical shaft with a spur wheel on its lower end, is to be turned by horse, or other power: this spur wheel takes into a smaller wheel on a vertical shaft, which passes through the hopper, in which has been put the clay and sand, loosely mixed together. The structure of the grinding part is not described. The clay is taken with no more moisture than it ordinarily contains, and when ground, is said to be sufficiently adhesive to form a fair brick by heavy pressure, and sufficiently dry to be put immediately into the kiln. The moulds for the bricks are to be made of cast-iron; these are placed under plungers, or followers, faced with iron, which are forced to descend by the action of horizontal arms which project from the upper part of the main vertical shaft; these, by means of rollers acting upon inclined moveable pieces of timber, force down the followers, and press the bricks.

The patentee does not state any particulars which he claims, but gives a general description of the machinery.

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8. For a machine for *Raising the Bodies of Wagons and other Carriages, from their Wheels,* and lowering them down again to their places; Thomas Scott, Louden, Franklin county, Pennsylvania, March 3.

A strong frame is erected, open at two opposite sides, like weigh houses for wagons. Two rollers turning on gudgeons, in collars,

* It is the practice of the superintendent of the patent office, to give such advice to applicants for patents, as may appear to him most likely to promote their interest, and also to demand models of patented machines, in general, to be deposited in the office, as, from them the views of the patentee may frequently be much better understood, than by such descriptions and drawings, as persons living in remote parts of the country, are able to furnish. In relationship to the two patents, Nos. 6 and 7, as well as to many others, he has been deprived of the opportunity of performing what he conceives to be his duty in this respect, by a person who was lately a clerk in the patent office, having unjustifiably passed many papers, through the forms of office, without submitting them to the superintendent, and who has, consequently, not known of their existence until after they had issued.

cross the upper part of this building. From each end of these rollers, a rope descends, which is looped at the lower end to receive a pole which is passed under the body of the wagon. On one end of each roller, there is a whorl to receive the rope by which the roller is to be turned. On one side of the frame, and immediately under the whorls at the ends of the rollers, there are two windlasses, with their cross bars, ratchets, and catches. From each of these windlasses, a rope passes round one of the whorls of the rollers, and by the aid of the two, a wagon, with its load, may be readily raised.

The patentee says, "I do not claim as my invention the above described rollers, or the wheels, or wrench, or ratchet, or hand; but I claim as my invention and improvement, the above described application of the wrench and rollers, as arranged, for the raising of the bodies of wagons and other carriages, whether loaded or not."

This, like many other patents, appears to have been obtained under a very prevailing, but, we think, a mistaken idea, that a patent can be sustained, excepting proof can be given that the same thing has been used in the same way, and for the attainment of precisely the same end, to which the patentee proposes to apply it.

Were it proposed, directly, to take out a patent for raising up a wagon by a common windlass, which has been universally employed for raising heavy weights of all kinds, the absurdity, we think, would be manifest; what more is done in the present instance, we do not perceive. If the merit is in the arrangement, this is so easily changed as to offer no security whatever; thus, in the foregoing machine, the end of each roller might have the windlass applied directly to it, without the intervention of the whorl and rope, and this, without being either a *discovery*, or invention, would, probably, be a better arrangement than that adopted.

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9. For an *Instrument for Tuning Piano Fortes*, and other musical instruments, denominated the CROMAMOMETRO; Peter Pettinos, Philadelphia, March 3.

This instrument is a monochord, or instrument of one string. By means of a screw, and a sliding brass box at one end, this string is strained up to the proper pitch. The whole instrument is somewhat in the form of a long, narrow guitar; upon its handle, a brass scale is screwed, so divided, that when a sliding piece is made to stop the string at the respective divisions, it will give the notes through an octave, of the proper temperament for a stringed instrument. At one end of the instrument, there is a key which causes a hammer to strike the string.

When used, the *Cromamometro* is to be placed on the piano forte, or other instrument, and with one hand the person strikes, simultaneously, the key of the cromamometro and piano; the moveable bridge being adjusted, successively, to each note on the scale; after which, nothing remains but to tune the remainder of the instrument by octaves.

10. For a machine for *Straight and Spiral Reeding and Fluting;* John January, Greenville, Kentucky, March 3.

This machine, which is intended to reed and flute bed posts, &c., is constructed much like some of the machines for cutting the grooves in rifle barrels. A bench is made, somewhat like a lathe, having between proper heads a cylindrical piece of wood, upon which may be cut straight or spiral grooves. A sliding frame has at one end a guide piece, which takes into one of these grooves, and at the other a cutter, which operates upon the piece to be wrought, this being so attached as to be carried round by the motion of the grooved cylinder; there is, of course, a dividing plate, and other necessary appendages. The general arrangement is claimed.

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11. For a *Press for Cider,* and other purposes; Daniel Reed, Easton, Bristol county, Massachusetts, March 3.

This press bears a strong resemblance to some others which we have seen, both patented and unpatented. Two upright cheeks are framed into sills. Two levers, which are drawn down by means of ropes, or chains, from two windlasses on the outside of the cheeks, force down two plungers, or sliding blocks, which act upon the pressing plank, or follower. As this is forced down, it is kept in its place by palls, or catches, which take into a rack within each cheek of the press.

There is a third windlass, with ropes, for the purpose of raising the levers, and thus taking off the pressure. The claim is to the general arrangement.

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12. For a mode of *Constructing a Tan-yard, and Tanning Leather;* Leonard B. Johnston, Tompkinsville, Monroe county, Kentucky, March 3.

The vats are to be so constructed, with tubes near their bottoms, connecting one with the other, so that the ooze can be conducted through, or stopped off, by means of a plug.

Within the vats on opposite ends, there are rows of wooden pegs, placed at about four inches from the top, and one inch apart; upon these the leather is to be hung, in certain parts of the operation of tanning.

The latches are made to communicate with the vats, in the same way as the latter communicate with each other.

We do not know what novelty there may be in the proposed arrangement; there, however, are tan-yards which have been long provided with means of communication from one vat to the other, which strongly resemble that described. The claim is as follows:—

"What I claim as new in constructing a tan-yard, and tanning leather, is the construction of the latches, tubes, and pins in the vats to hang the leather on; and the whole mode of tanning as stated in the specification."

13. For *Canal Boats*, to be propelled by steam power; Benajah Williams, Mendon, Monroe county, New York, March 3.

"The improvement consists of two boats, connected by one deck. These boats are to be built with the ordinary curvature outside, but straight throughout on the inside. In the space between these two boats, is the wheel by which it is propelled, by ordinary steam machinery, placed within the two boats. If necessary, two wheels may be used, by having additional machinery of the same kind."

The foregoing is the whole of the specification. We apprehend that the plan will not fulfil the condition of being *new* and useful.

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14. For *Manufacturing of Woollen Carpet or Carpeting*, by which the carpeting is manufactured without spinning, or weaving; William Harrington, Harrison, Westchester county, New York, March 3.

The specification of this patent refers, throughout, to the accompanying drawings, but the petition contains a very clear and ample view of the leading features of the invention, which we subjoin.

"The wool is first picked in the same manner as it is commonly prepared for carding rolls, then carded in a carding machine of the same kind as is used to card rolls, except the finishing doffer of the carding machine, the whole surface of which is covered with filleting cards, and from which finishing doffer the wool thus carded is separated by a moving comb, (such as is used in carding rolls,) and comes off in a thin web, which is received upon a wooden drum, standing within five or six inches of the end of the carding machine, upon which this web of wool, by the turning of the drum in an opposite direction to the doffer, is wound one web upon another, till it becomes of sufficient thickness for the carpeting. When this bat of wool, thus formed and pressed together (by a roller over the drum, under which it passes each time the drum goes round,) is of sufficient thickness, it is cut by a pair of shears, lengthwise of the drum, and by the motion of the drum turns off, and is succeeded by another formed in like manner. After a sufficient number of these bats of wool are formed, in the manner above mentioned, to make a piece of carpeting, they are joined together by picking off about half the thickness of wool at one end of each of the bats intended to be joined together, and lapping one end upon the other, and pressing them with the hands till they adhere together, and appear smooth and even at the place where they have been thus united. The piece thus formed is folded into linen cloths, so that each layer, or fold, is separated from the other by the linen cloths, and the outside of all the folds also, covered with the same; in this situation it is placed in a wooden box, resting on coarse linen cloths moistened with water, which cover a cast-iron plate, over a furnace of brick, which heats the plate, and with the lid of the box closed, is steamed about twenty minutes. When sufficiently steamed, the whole piece in the linen cloths is taken from the steamer, and placed upon a table under a large wooden pad (upon which rests a weight of fifty-six pounds, or

more, if necessary to increase the pressure) which pad is moved horizontally across the folds of the piece by a crooked iron crank turned by water; and in the space of about half an hour, will harden the whole piece, and make it nearly as strong and firm as flannel before it is fulled. After it is thus hardened, the piece is removed from the linen cloths, and fulled in the fulling mill, in the same manner as flannel and cloth usually are, with soap and water; it is then washed with water in the fulling stocks, taken out, and dried upon tenter bars. The piece of carpeting is then sheared in the same manner, and by the same machinery, as cloth is, usually; then cold pressed to make it smooth; the edges trimmed; when the carpeting is white and smooth, and is prepared to have the different colours and figures stamped upon it by the dyers and printers."

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15. For *Machinery to be used in Navigation*, chiefly applicable to the propelling of ships, and other floating bodies, and some of which improvements are also applicable to other purposes; Adolph Heilbronn, New York, March 16.

This patent is for an improvement on the paddle wheel; for an advantageous mode of applying human power to the working such wheels; and for an improvement by means of which vessels are to be prevented from making so much lee-way as usual. This patent we shall hereafter present more at large than we are now prepared to do, and, probably, with illustrative engravings.

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16. For conveying commodities, goods, wares, merchandise, produce, &c., upon *Roller Ways* or *Roads*, by means of carriages adapted to run on said ways, or roads; John Gardiner, Washington, D. C. March 16.

This is a patent for running rails upon wheels, instead of wheels upon rails. Posts, or standards, are to be put into the ground, in rows, near to each other. Rollers with rims are to revolve upon gudgeons at the tops of these standards. The carriages are to be made with runners, like the runners of sledges, or sleighs. The patentee calculates that this plan will be very *economical;* more durable than the ordinary rail road; less subject to injury from frost, or to being obstructed by snow, and very convenient to the farmer, who can make his own carriage, "for little or *nothing*." The carriages may also cross, or navigate, rivers which may be in the course of the road; it being only necessary in this case that "the carriages be built like scows, or gondolas."

Notwithstanding all the advantages enumerated by the patentee, we are apprehensive that there will be an *obstinate* perseverance in following the old plan, on the part of those interested in the construction of rail-roads.

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17. For an improvement in the *Setting of all kinds of Boil-*

ers, for consuming the Pennsylvania anthracite, or any other fuel; John Lovatt, Philadelphia, March 17.

This specification describes the mode followed by the patentee, in fixing doors, dampers, bars, flues, floats, &c. &c. What is claimed is not stated, nor does it appear to us that he has in any instance separated the old from the new in his plans. There are numerous figures and references, which we do not think it necessary to give.

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18. For an improved *Churn;* Zuri S. Doty, Groton, Tompkins county, New York, March 17.

The body of this churn is in the form of the common upright churn. A vertical shaft passes through the lid, and into a cross piece above it. Upon that part of the shaft which is above the top of the churn, there is a small cog wheel, or pinion, which is turned by a vertical wheel, operated on by a crank, or winch. The dashers consist of thin slats, set spirally round the shaft, at an angle of about 45 degrees with the surface of the cream. The points claimed are not stated, but the advantages said to result from this arrangement, are, ease of working, and rapidity in producing the intended effect. The mode of turning is very old.

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19. For a machine for *Ascertaining the Rate of a Ship or other Vessel's motion* through the water, and also the velocity of tides; James D. Woodside, Washington, D. C. March 17.

This machine the inventor denominates a *Perambulator*. The choice of a name is not a happy one, as it is already applied to a well known instrument, and as relates to the machine in question, it is a misnomer. Many instruments have been invented for the purpose of measuring the velocity of tides and currents, and of ascertaining the way of a vessel, and patents have been obtained for several of them, both here and in Europe, some of which have been noticed in this Journal. Practice, the surest test of the operation of machines in general, has not so established the character of either of them as to have continued them in use; we do not now speak of the more recent attempts. Some of them, we thought, wore as fair an aspect as the one before us; may its course be more prosperous than theirs. The following are its leading features.

A water wheel has 4 wings so constructed as always to present their flat surfaces to the water on one side, and their edges on the other: these wings turning upon pins in brass rims, with suitable stops, in the manner of some horizontal wind-mills, and of many water wheels which are placed wholly under water. This water wheel is let into the stern post, about 12 inches below the water line. Its axis extends up the stern post, in a groove, which admits of its being covered by the copper sheathing, and reaches to the top of the rudder casing, in the cabin. An endless screw on the upper end of this axle, gives motion to a train of wheels, furnished with indexes to

point out the distance travelled, or rather the number of the revolutions of the water wheel.

The patentee states that the diameter of the wheel is 4 inches, and its circumference 12; (this is not exactly "according to Gunter:") that when placed in a tide, or current, it will move with its velocity, and make 5280 revolutions in a minute, this being the number of feet in a mile. The number of teeth in the wheels is calculated upon these data, which are manifestly erroneous, as a circle of 4 inches in diameter is upwards of 12 and a half inches in circumference; nor will such a wheel as this move with the velocity of the current, but must differ from it very considerably; the water operates with different degrees of force on the different parts of the wings; and the effective diameter will, therefore, be much below 4 inches: friction, the resistance of the returning wings, or buckets, and the actual loss from their turning, all conspire to impeach the calculation. We are of opinion that if the instrument prove to be good, the actual revolutions of the wheel, in relationship to the velocity of the water, must be ascertained by observation alone.

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20. For an improvement in the *Mode of Drawing Water from Wells, Cisterns, &c.*, for which a patent was obtained on the twentieth day of August, 1828; Samuel Smith, Mendon, Monroe county, New York, March 17.

We gave an account of the original patent in our last volume, p. 258. The present improvement appears to us to bring the thing back to the common pump, exactly. The patentee states, that he uses "the usual upper part of a pump, with a handle, shaft, tube, and boxes, in the usual way; but instead of sinking the log down into the well, or cistern, as is customary, a tube of metal, earth, or wood, is inserted into the well, or cistern, precisely as is described in the letters patent before adverted to; and the common pump head may stand in any place required." That is, if we understand the meaning, the pump need not stand directly over the well, but a pipe may lead from a kitchen into a well in the yard, and the pump be worked in the kitchen, as has been repeatedly done, time out of mind.

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21. For an instrument for *Sharpening and Improving Knives*, and other edged tools, denominated the "Carving Knife Renovator;" Isaiah Jennings, New York, March 17.

The principle upon which this instrument acts, is the same as that of the "Compound Guard, and Knife Sharpener," described p. 341; but instead of wheels, or disks of hard steel, intersecting each other, two pieces of flat hard steel are fixed in a block, from which they stand up, their flat faces touching, but their edges diverging from each other, so as to resemble the blades of a pair of scissors partially opened. Two or more pairs of these may be fixed in a line with each other, and the knife to be sharpened drawn through them.

The resemblance between this instrument, and one for which a patent has been obtained in England, by Francis Westby, will be seen by turning to the account of that patent in the present number; where will be found another modification of the same principle.

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22. For an improved plan of *Constructing Clocks;* Aaron D. Crane, Caldwell, Essex county, New Jersey, March 18.

(See specification.)

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23. For an improvement in the *Power Loom*, in adding thereto an engine to weave figured cloth of every description; William Levally, Canterbury, Connecticut, March 18.

The power looms to be used are those of the ordinary kind. The improvement consists of an engine, on a part of which the intended pattern is formed in such a way as to act upon a lever, which, by the intervention of suitable machinery, serves as a guide to the pattern. When a new figure is required, a part which is suited to direct the machinery in forming such pattern, has to be prepared and in its proper situation.

The drawing and description do not enable us to comprehend the plan fully, and if they did, it is probable that an engraving would be necessary for their explanation. A model is to be furnished for the office, but has not yet arrived.

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24. For *Polishing Screw Augers;* David Bassett, Derby, Connecticut, March 18.

This patent is taken for the *manufacture*, and not for the machinery employed. The ordinary screw auger is to be ground true, and polished throughout, by means of stones and buffs, in the way well known to workmen. The patentee thus states his claim.

"What I claim as new in this invention, is the auger thus made by me, whether the brightening, smoothing, or polishing, be performed by the means aforesaid, or by any other means producing the same effect."

The advantages stated to result from polishing, are the lessened liability to corrosion, and the greater ease of working, from the facility with which the chip is delivered.

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25. For an improvement in *Rail-way Carriages;* Isaac Knight, Baltimore, March 18.

For the application of friction rollers and friction wheels, to railway carriages, several patents have been recently granted, and it is acknowledged by some of the patentees, that these plans are essentially the same, and that the validity of the claim of either must rest upon the proof of priority of *invention*, or rather of adaptation. For ourselves, we do not think that the merit of this question actually lies in so narrow a compass. Friction wheels are well known

applications among machinists, and it is certainly a question whether the employment of them in rail-road carriages can be called either an invention or discovery, although it may actually be an improvement. It is highly probable that the contending claims of those who have obtained or applied for patents for this application of the friction wheel, may lead to the determination of this point before the competent tribunal.

It does not appear necessary to say more about Mr. Knight's patent, than that it is for the employment of friction wheels above, and, sometimes laterally also, to the axles of rail-road carriages, to prevent the rubbing friction against the sides of the boxes in which the axles are to revolve. The specification concludes as follows.

"My invention mainly consists in the application and combination of the foregoing well known principles to the purposes of the transportation of goods, and all kinds of burthens and passengers on rail-roads."

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26. For the manner of *Forming the Spire, or Roll of Yarn, on a Weaver's, or Shuttle, Bobbin;* John Thorp, Providence, Rhode Island, March 18.

Several of Mr. Thorp's improvements will be made known in an early number, agreeably to our several notices to that effect. They are now in the hands of the engraver: the above will appear among them.

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27. For the *Manner of Cutting Ice*, together with machinery therefor; Nathaniel F. Wyeth, Cambridge, Middlesex county, Massachusetts, March 18.

The machinery for cutting ice described in this patent, consists principally of two distinct instruments, the first operating as a straight, the second as a circular saw, both to be acted upon by horse power. The first consists of a quadrangular frame of iron, about three feet in length, and twenty inches in width. Plates of steel, or of iron pointed with steel, are fastened along the two opposite edges of this frame, so as to project from, and stand at right angles with each side of it, forming the plough, or saw, with which the ice is first to be cut. At the first angle, this saw projects but one inch from the frame, and increasing an inch in each successive angle, projects four in the last. On each edge there are but four cutting points, or teeth, each cutting one-fourth of an inch deeper than that which precedes it.

This frame is to be drawn along upon the surface of the ice, when two grooves will be cut about twenty inches apart, and one inch deep. By turning the frame so that the saws may successively run in these grooves, they are cut to the depth of four inches. The field of ice is then crossed, and thus divided into squares, when the second instrument is to be used.

The second instrument consists of a two wheeled carriage; the wheels having iron teeth on their rims, to take hold of the ice, and

cause them to revolve. These wheels are firmly fixed upon a common axle; upon the middle of this axle is a toothed wheel, from which motion is communicated to a circular saw, at the tail of the carriage; this saw is about two feet in diameter. The whole is to be drawn like a plough, a man following, and by means of handles guiding, and depressing or elevating the saw.

"It is claimed as new, to cut ice of a uniform size, and by means of an apparatus worked by any other power than human; the invention of this art, as well as the particular mode of the application, are claimed by the subscriber."

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28. For an *Economical Cooking Stove;* John J. Hess, Philadelphia, March 19.

"This stove consists of seventeen pieces, or plates, independent of eight doors, and three grates, all resting upon four feet, which, when properly applied, and put together, form a perfect, whole, and entire construction, capable of performing, with rare economy, a great variety of cooking operations, together with numberless other services in housewifery, being heated by a very small portion of wood, or anthracite coal."

The foregoing is the exordium of the specification, and the following is its peroration.

"With this apparatus, and attentive care in its operations, great economy must be preserved in the consuming material used for fuel. Steam is generated from the boilers, and when received into proper vessels, can be applied to all the delicate cookery of luxurious dishes, without the aid of assistants; an important advantage to families. Boiling water is always in readiness; and with the same fire, baking of meats, and bread, or fruit, roasting, broiling, stewing, frying, boiling, and fricaseeing, are expeditiously going on, at one and the same time!" JOHN J. HESS.

There is a something so stimulating in the foregoing enumeration of properties and results, as to make us wish to anticipate the usual "hour of prime;" and had we one of Mr. Hess's stoves, we certainly should hurry the cook. As it is impossible to describe this stove without engravings, and as most of our readers, like ourselves, are more inclined to partake of a good dinner than to study the means of preparing it, we will merely give them the address of the patentee, who resides at No. 237 North Second Street, Philadelphia, who is prepared to gratify the *taste* of those who will apply to him.

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29. For an improved *Machine for Napping Cloth;* Moses R. Norris and Lyman Phillips, Covington, Genesee county, New York, March 21.

This napping machine, or gig mill, is furnished with three different cylinders, either of which may be placed in the frame, according to the nature of the work to be performed. One of these cylinders is to be covered with "common machine cards, cut or made in strips lengthwise, say one and a half inch wide, so that they will work

sideways to the cloth, which causes it to work tender, and not damage the cloth;" or the card teeth may be set straight. The second cylinder is covered with teazles, and the third with brushes. There are also what the patentee calls "canting raising spreaders," for the purpose of spreading the cloth as it passes in either direction.

The machine is not very clearly explained, or the difference between it and others very distinctly stated. The claim is, "the frame, or manner of constructing it. Straight teeth on the card or cylinder. Canting raising spreaders. The manner of shifting the machinery. Manner of driving the gearing by the main band. Extra cylinders."

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30. For *Ornamenting Picture, Looking-Glass, and other ornamental Frames,* called "the Jackson Ground;" John Parker and Lewis P. Clover, New York, March 23.

(See specification.)

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31. For an improved *Salt Pan;* William Blocksom and John T. Fracker, Zanesville, Muskingum county, Ohio, March 23.

(See specification.)

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32. For a pattern for *Moulding and Casting Composition Spikes,* butt bolts, and other castings; Joshua Sewall, and Charles Sewall, Bath, Lincoln county, Maine, March 25.

A plate of metal, of any suitable kind, from one-eighth to half an inch in thickness, is cast with one-half of the pattern of the spikes on each side; these half spikes standing anglewise, to deliver well from the sand. This plate is made to suit the size of the flasks to be used, and fitted to the dowells, or pins, which cause the flasks to match. To those who understand any thing of casting, the mode of using it will be obvious.

The patentees "claim as new, the method of making the above described plate, or pattern, for casting, with the sections of the spike on each side thereof, so exactly corresponding as to give the perfect shape of the spike, and so fixed upon the plate as readily to draw from the sand. The method of moulding spikes by the pattern, by which the spikes may be cast with points as wide, or wider, than the shanks, and which will, consequently, draw better than spikes moulded by pricking in the pattern, or moulded in any other way now known to be in use. The advantage of having the sections of the spikes so affixed to the plate, that they present on each side of the pattern, a half of the spike from corner to corner, with the point on the one side of the plate indented, and on the other side raised, so as to give the perfect shape of the spike when cast. Also the great saving of time and labour in moulding with the above described plate, or pattern."

The indentation and raising, mentioned, relate to the form of the mould, which is necessary, in consequence of the widening out of

the end of the spike. The latter part of the claim, is, we apprehend, mere surplusage, as the saving of time is scarcely a patentable article; and the means by which this is accomplished, had been already claimed.

We have seen the half patterns of spikes fixed upon mould boards; not upon the opposite sides of the same board, but upon two separate boards; this is the nearest approach to the plan of the patentees with which we are acquainted.

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33. For apparatus to *Prevent Wind, Water, &c. from Driving under Doors;* William Cole and John Johnson, Randolph, Norfolk county, Massachusetts, March 27.

A strip of wood, or metal, plays loosely in a groove under the rail of the door; this strip is kept up by a spring when the door is open; by shutting the door, a lever is made to act upon this spring, and to force the strip down upon the floor, or sill. It is stated that the other edges of the door may be guarded in a similar manner.

In the plan adopted, the lever, with its appendages, is fastened upon the centre of the lower rail of the door, and occupies nearly its whole width, and would be, generally, accounted an eye-sore. We have seen a plan in which a similar strip was employed, and forced down by a wire which shot out to the distance of about half an inch, just above the strip at the back edge of the door, where it could scarcely be discovered. This wire, on shutting the door, was forced in by the rebate of the door frame, and caused the strip to descend.

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34. For the discovery of a *Water Proof Cement,* or hydraulic lime; Robert Leckie, Washington, District of Columbia, March 31.

The specification will appear in the next number.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for Making Bricks, Tile, or other Clay Ware. Granted to JAMES WOOD, *Haverstraw, Rockland county, New York, March* 3, 1829.

TAKE of the common Lehigh coal (or coal of any other kind which is found not to swell in burning) such quantity as will best suit the kind of clay about to be moulded into brick, tile, or other clay ware when mixed with it, (that is, the clay,) after the coal being completely and finely pulverized, in any way or manner that may be found most convenient by the manufacturer.

There are no particular proportions of the clay and pulverized

coal to be used in making these brick, tile, or other clay ware; these depend upon the nature of the clay to be used.

The finer the coal is pulverized, the better it is, invariably, found to answer for this mode of making bricks, &c.

Any kind of coal may be used, with the exception of such as swells in burning. These bricks, &c., are burned in the common way, but they require a much less quantity of wood in the process of burning, than those brick, &c., which are composed of clay alone. Brick composed of these ingredients, are of a better colour when burned, than the common clay brick. JAMES WOOD.

Specification of a patent for an improvement in the plan of Constructing Clocks. Granted to AARON D. CRANE, *Caldwell, Essex county, New Jersey, March* 18, 1829.

BE it known that I, the said Aaron D. Crane, have invented a new and useful improvement in the making of clocks, which invention is as follows. This improvement, in the time part of the clock, consists in making it with only two wheels. One wheel with a barrel, similar to that of a common clock, only much smaller; this wheel drives a second wheel, which has pointed teeth, like those of the swing wheel of a common clock. The teeth of this wheel work on a small pallet, projecting from an arbor, on the back end of which is fixed a rack with twenty-nine teeth. The wheel acting on the pallet of this arbor, throws the rack back, when the wheel is locked, and the rack is carried forward by a light weight attached to it, and the teeth of the rack, acting on a pallet on the arbor, to which the stirrup, or guide, is fixed, keeps the pendulum in motion.

The pendulum rod is about six inches and a half long, with a very light bob, and has a balance attached to it, consisting of a slender bar about ten inches long, with a weight of six ounces at each end.

The striking part has only one wheel, which has pointed teeth, which works on a pallet in the hammer arbor, and causes it to strike the hour; and the time between the strokes is regulated by a balance attached to an arbor running through the clock, with a pallet working in the teeth of the striking wheel.

The hour is struck on strings of wire, or cat-gut, drawn over a box of thin boards about two feet long, and three inches wide.

The hands are carried without wheels. A pipe, or socket, slips into the arbor of the centre wheel, to which the minute hand is fixed, and on the back end of the pipe is fixed a spiral piece of brass, which, as it revolves, raises a hook which catches a notch in a plate on the back end of the hour socket, and moves the hour hand. All these several parts of a clock, I claim as my own invention.

AARON D. CRANE.

Specification of a patent for Ornamenting the Grounds of Picture, Looking-Glass, and other Ornamental Frames, called "The Jackson Ground." Granted to John Parker *and* Lewis P. Clover, *New York, March* 23, 1829.

This improvement consists in taking the common foundation lace unfigured, or any species or pattern of cotton, thread, silk, or any other lace, figured, or ornamented, or unfigured, or any thin fabric where the figure or texture projects above the surface of such varied sort, or pattern, as the fancy of the artist, or its cheapness, may dictate, and having previously prepared the ordinary picture or other required frame, in the usual plain manner, with a smooth surface, the aforesaid lace, or other fabric, is then sized over with glue, or any other substance which will cause it to adhere to the frame; it is placed on the aforesaid smooth surface of the frame intended to be ornamented, and after the same has firmly adhered to said frame, it is gilded over, or silvered, painted, or bronzed, in the usual manner of gilding, silvering, painting, or bronzing of frames.

The value of the improvement consists in the saving of labour and expense in the production of an ornamented surface to frames, and in the beautiful figure in the fabric, and figure of the lace, or other fabric, being thus transferred to, and becoming an ornament on the surface of the frame, and also in being a more expeditious method of ornamenting a surface to be gilt, than moulding, or casting, as now practised. This improvement may also be applied to the surface of any article of useful or ornamental furniture where the surface requires to be ornamented.

John Parker.
Lewis P. Clover.

Remarks by the Editor.—There has been deposited in the patent office a specimen of one of the frames ornamented in the manner above described. Bobbin-net, or other lace of a similar texture, has been affixed so as to cover the hollow of a bold wide picture frame; and the gilding laid upon this, produces a very beautiful effect, and one which it would be extremely difficult, if not impossible, to imitate, by any other process. We have seen but few things of a character equally simple and pleasing.

Specification of a patent for an improved Salt Pan, for boiling Salt Water, for the manufacturing of Salt. Granted to William Blocksom *and* J. T. Fracker, *Zanesville, Muskingum county, Ohio, March* 23, 1829.

Be it known that we, the said William Blocksom and John T. Fracker, have invented a new and useful salt pan, for the purpose of boiling salt water in manufacturing salt, specified in the words following.

This pan consists of a number of parts of cast-iron of a suitable thickness, say five-eighths of an inch, two feet long, four feet wide, and fourteen inches deep, or these dimensions may be greater or less, the bottom and sides forming a semi-ellipsis with flanches projecting inwards at right angles from the bottom and sides, half an inch thick, and two inches wide, through which, holes half an inch in diameter and about six inches apart, are drilled to admit screw bolts; the parts are to be put together and the seam cemented, the ends enclosed by a plate of cast-iron, through which holes are drilled corresponding with those in the flanches, and secured in the same manner as the other parts; by using fewer or more parts, the pan can be made to any length to suit the manufacturer.

The mode of using this pan in manufacturing salt, is, first to build two stone walls parallel to each other, of a proper length, height, and distance apart, to receive the pan, on the top of which the pan is to be set; this forms a furnace, at one end of which a chimney is built for the purpose of creating a current of air through the furnace; at the other end of the furnace the fire is applied to heat the pan for boiling the salt water.

What we claim as our invention and improvement, is, the bottom and sides being elliptical, or circular, which gives the metal an opportunity of contracting and expanding, without breaking.

WILLIAM BLOCKSOM.
JOHN T. FRACKER.

Specification of a patent for the Cure of Crooked, or Inflected Spine, in the Human Body, consisting of various instruments, to be called the "Dormant Balance." Granted to JAMES K. CASEY, ESQ., *of New York. First issued, June 23d,* 1828, *afterwards surrendered for the purpose of amending some defects in the specification, and re-issued, January 21st,* 1829.

(WITH A COPPER-PLATE.)

THIS machine consists of a plane frame, the flat surface of which is about the size of a common mattress, and upon the longer edges of which, gudgeons, or centres, are fixed, at or near its centre of gravity. These gudgeons, or centres, are received into proper boxes, or bearings, on fixed supporters, the height of which a little exceeds the length of the frame. The frame, therefore, can revolve upon its gudgeons, or centres, as about an axis passing through it in the direction of its breadth. Upon the top of this frame, there is a bracket, from which is suspended, by a cord passing over a pulley, braces, and bandages, to be attached to the head of the patient.

The whole apparatus is shown in the annexed drawing and explanation.

The mode of operating with this apparatus, is as follows. The frame being brought into a vertical position, or nearly so, upon its

gudgeons, the patient is made to stand with his back against the side of the frame. The braces and bandages are then attached to his head, which is then drawn upwards by the cord passing over the pulley. By the direct gravitation of the lower part of the body, acting in opposition to the force by which the head is drawn upwards, the body is extended and the spine straightened. The force to be applied by the cord, must be varied according to the circumstances of the case; commonly about fifty pounds are required. After this extension has been continued from five to thirty minutes, the frame should be turned gently upon its axis, bringing the patient to a horizontal, or nearly horizontal, position, with the frame under and supporting him, the frame being kept in place by horses, chairs, or any proper supporters. The bandages are then to be removed from the head, and in this position the patient should remain an hour, or more, as may be convenient.

When the patient intends to remain long in the horizontal position, it will be necessary, previously to turning the frame as before described, to interpose between it and the patient, a mattress or other soft body. The foregoing operation should be repeated from day to day, twice or three times a day, until the distortion disappears.

In the preceding specification I have, for the purpose of making the application of my improvement more clearly understood, described with it certain instruments and parts which do not belong to this invention. Therefore, I hereby declare my invention, for which I claim letters patent, to consist in the combination and arrangement of the moveable frame with its supporters, and in making the braces and bandages to correspond with the motion of the head and the exercise of the arms and body, and thus, without danger or exposure to accident, providing for making an extension of the spine, when the patient is in a standing position; by which the extending force is counteracted by the whole weight of the body; and also providing for changing the position of the patient, from standing to recumbent, without removing him from the machine. JAMES K. CASEY.

Explanation of the Plate.

Figures 1 and 2 represent different positions of the apparatus, which can also be readily placed horizontally, in which case tressels, or horses, may be placed under the ends of the frame.

A, the moveable frame, suspended by

B, B, the gudgeons.

C, C, the supporters.

a, b, c, braces and bandages to be applied as shown in the drawing, which also exhibits the manner in which the pulley acts.

Remarks by the Editor.—In our list of patents for June last, we noticed this invention, and subsequently published the original specification. The patentee soon found that this specification was defective; he, therefore, surrendered his patent, which was re-issued with the foregoing description.

In our previous notices of Mr. Casey's apparatus, we have spoken

Fig. 2.

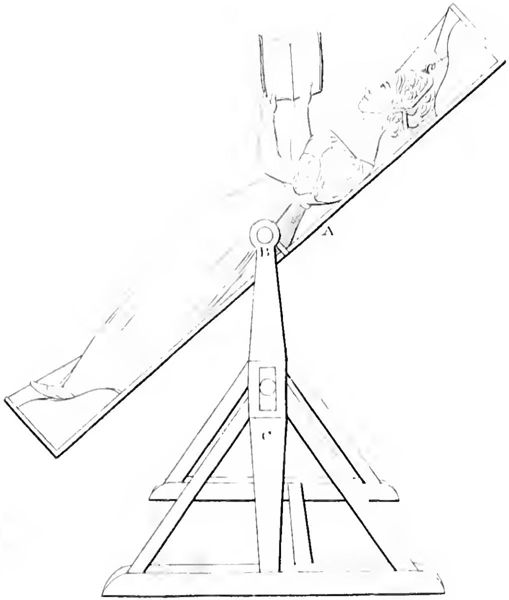
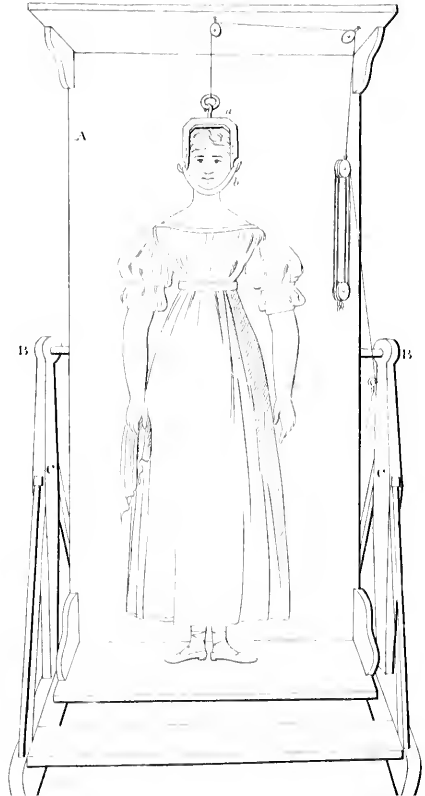
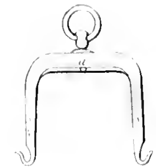


Fig. 1.





of it in very favourable terms. The opinion which we entertained, received a very powerful support from the unqualified terms of approbation in which a very distinguished physiologist had expressed his conviction of its value; our intimate acquaintance with the individual to whom we referred, justified the confidence with which his judgment was received. Since that period, the instrument has been applied in a number of cases with the most perfect success.

We with pleasure enter more into detail respecting this apparatus than we usually do with patents, because we feel that the subject is one of great interest in itself, and more particularly so, as it relates to the cure of a complaint, the sufferers from which are numerous, and to which those whom nature has cast in her finest mould, are the most frequently subjected. We believe that the patentee has supplied what was, until now, a great desideratum in medical mechanics. With the inventor we have no personal acquaintance, and in the invention we have no interest but that of humanity. We have corresponded with Mr. Casey, and with others, upon the subject, and we are authorized to say that doctors Cheesman, D. W. Kissam, jr., D. Kay, and George Wilks, of New York, who professionally visited the British isles, and the continent of Europe, have awarded to Mr. Casey's method of treatment, a character of decided superiority over any thing which they have elsewhere witnessed. We are also assured that every practitioner of eminence who has carefully examined its operation, has concurred in the same opinion; and are informed that upon this united testimony, Dr. John B. Ogden, of New York, a gentleman of talents, and of the most respectable connexions, has taken the apparatus to Europe.

The late deeply and justly lamented Dr. King, son of the Hon. Rufus King, pronounced the Dormant Balance the *only* machine which, in his judgment, could effect a cure; as, by it, the power which is necessary to accomplish the object, *permanently*, may be applied, with perfect ease and security to the patient.

We deem it unnecessary to give the very long array of the names of distinguished practitioners with which we have been furnished, whose opinions are altogether approbatory, but we add an extract of a letter to Mr. Casey, from the pen of a very learned and reputable physician in Boston, who has distinguished himself by his physiological disquisitions in a valuable journal of which he is the editor.

"My opinion, as you are aware, must be founded partly upon the knowledge which I have of the cases in which it has been employed, and partly upon general reasoning with regard to the effect of such an application upon the human body. Without having seen a single case, I should have judged that your apparatus, if made use of for a sufficient length of time, and upon a person not too far advanced in life, would generally effect a cure. After having seen it applied in two cases repeatedly, and in a third once, I am ready to say that the *immediate* influence exerted upon the curved spine, is greater than I should have anticipated; and that the *permanent* change produced in the *shape* and *height*, is such, even after the short period during which the machine has been applied, as fully to confirm the

opinions I had formed. In short, all that I have seen and known, leads me to believe that your method is superior to any known, and that, if persevered in, with the use of the proper means for preserving and improving the general health, it will prove successful in all but the most aggravated cases."

Mr. Casey has used his apparatus extensively in the cities of New York and Boston, and is now in Philadelphia. He is accompanied by his lady, who attends to those patients who prefer the aid, and require the instructions, of one of their own sex.

In publishing patents for things appertaining to the healing art, we rarely feel any sensation but that of disgust at the facility with which quacks impose their nostrums upon the community, and increase the evils which they propose to cure; but in cases like the present, the instruments speak for themselves, and the judgment, not the credulity, is addressed.

Observations on the Inclined Plane, the Wedge, and the Screw, as Mechanical Powers. By D. H. Mason, Mechanician.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—Scientific gentlemen in their lectures and treatises on mechanics, and mechanicians in general, have considered the inclined plane, wedge, and screw, to be very nearly allied, if not identical in principle, promiscuously calling them by their different names; as this opinion appears to me incorrect, I am induced to offer the following remarks for publication in your Journal.

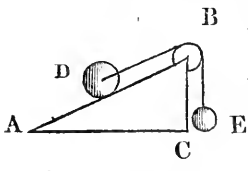
Yours, &c.

D. H. Mason.

It may be proper to offer in the commencement of my remarks, what may be considered a correct definition of the inclined plane and wedge.

The inclined plane is merely a plane surface, inclined to the horizon, and is used to raise weights from one level to another.

The power required to sustain a weight on an inclined plane, is in the same proportion to the weight, as the perpendicular height is to the length of the inclined surface.

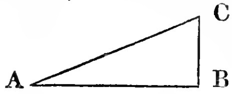


Let the hypothenuse A, B, represent the weight D, then the perpendicular C, B, will represent the power E, sufficient to sustain the weight on the plane. And the base A, C, will represent the pressure of the weight D, on the plane.

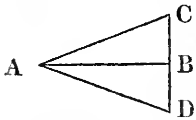
These proportions will invariably hold good in all inclinations of the plane. The power to raise a weight on an inclined plane, should always act in the direction of the plane, otherwise it is a compound machine, partaking in part of the principles of the wedge.

The wedge is a triangular piece of metal, wood, or other substance, and is used to separate bodies.

The power and resistance are in the same proportion as the base and perpendicular; or in a double wedge, as the length through the centre, and half of the back.



Let the base A, B, represent the resistance, the perpendicular B, C, will represent a power sufficient to sustain the resistance, so that the power and resistance will be in equilibrio.



Or in a double wedge, let the centre A, B, represent the resistance, then half the back C, B, will represent a power sufficient to sustain the resistance, so that the power and resistance will be in equilibrio.

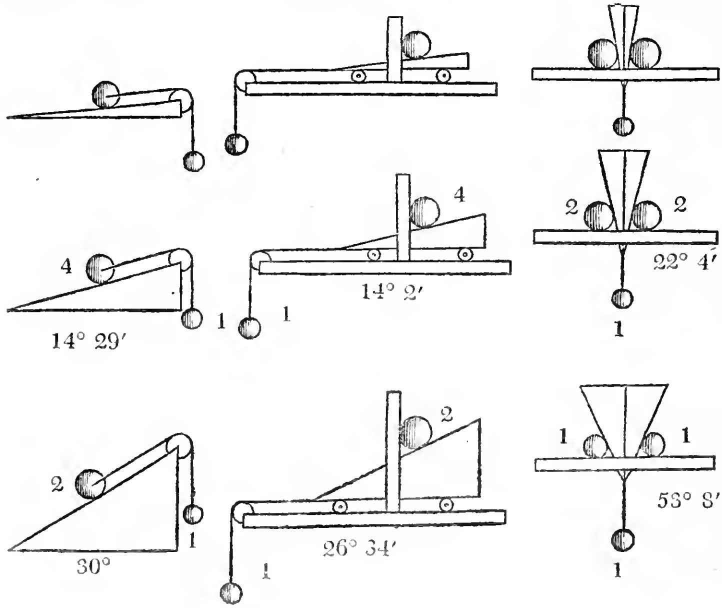
These proportions will invariably hold good, in all angles of the wedge.

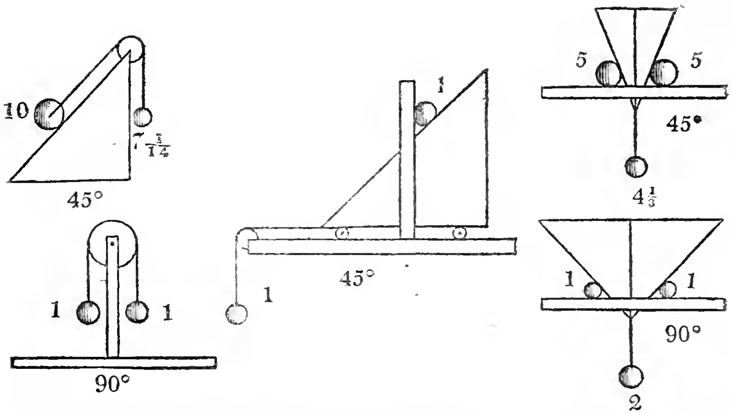
In the wedge, the power should always act in the direction of the base, or centre, otherwise it partakes of oblique pressure.

In all machines, when the resistance is to be overcome, the power must be increased, sufficiently to overcome the friction.

Having premised thus much, I shall give a number of diagrams of the inclined plane and wedge, commencing with a small angle where they may be considered nearly equal, and increasing in the angle, giving the proportions of the power and resistance in each, which will exemplify a vast difference in the two machines.

Inclined Plane. *Single Wedge.* *Double Wedge.*





From the foregoing diagrams and premises, it is evident that the following differences exist in the inclined plane and wedge.

In the inclined plane, the power acts to the greatest advantage, in the direction of the plane.

The power and resistance in the inclined plane, are calculated by the hypothenuse and perpendicular.

In the inclined plane, at an angle of 14 degrees 29 minutes, the power and resistance are as one to four.

In the inclined plane, at an angle of 30 degrees, the power and resistance are as one to two.

In the inclined plane, at an angle of 45 degrees, the power and resistance are nearly as seven and a fourteenth to ten.

The power and resistance are equal in the inclined plane, at an angle of 90 degrees.

In the wedge, the power acts to the greatest advantage, in the direction of the base, or in a line through the centre.

The power and resistance in the wedge, are calculated by the base and perpendicular, or by a line through the centre and half the back.

In the single wedge, at an angle of 14 degrees 2 minutes, and in the double wedge, at an angle of 28 degrees 4 minutes, the power and resistance are as one to four.

In the single wedge, at an angle of 26 degrees 34 minutes, and in the double wedge, at an angle of 53 degrees 8 minutes, the power and resistance are as one to two.

In the double wedge, at an angle of 45 degrees, the power and resistance are nearly as four and one-third to ten.

The power and resistance are equal, in the single wedge, at an angle of 45 degrees, and in the double wedge at an angle of 90 degrees.

The inclined plane can never exceed 90 degrees.

The single wedge may be made nearly to an angle of 90 degrees, and the double wedge nearly to an angle of 180 degrees.

In the inclined plane, the power can never exceed the resistance.

In the single wedge, having an angle greater than forty-five degrees, and in the double wedge, having an angle greater than ninety degrees, the power will always exceed the resistance, therefore it may be denominated an inverted wedge.

The following are legitimate conclusions from the foregoing.

The inclined plane and wedge are distinct mechanical powers.

The single wedge is the most simple form, as the double wedge is two single ones together.

The double wedge may always be calculated as to the proportions of power and resistance, as a single wedge having half the angle of the double one.

The inclined plane and wedge proceed in different ratios of angle, from a small to a greater, for the same power.

The Screw.—The screw may be denominated a spiral wedge, and in all its applications never acts as an inclined plane, which will be evident on considering the laws of the plane and wedge, as stated above; the method of calculating the power and resistance, is also the same as the wedge; one circumference of the screw gives the base, and the distance from the centre of one trait, or thread, to another, gives the perpendicular.

The screw, however, must be considered as a compound machine, being in almost all its applications necessarily turned by a lever, which must be taken into account in calculating its power, in which case the distance the end of the lever (where the power is applied) passes in one revolution gives the base, and the distance from the centre of one trait to another gives the perpendicular. And further, the screw is always used double, having a counter screw, or that which is equivalent to it, as the teeth of a wheel in a tangent screw.

This statement respecting the screw, is not meant to exclude the existence of a spiral inclined plane, such as the representation of the Tower of Babel, or an ascending road round a hill or mountain, which differ materially from the screw, in the calculation of the power and resistance, having no resemblance to it but its spiral form.

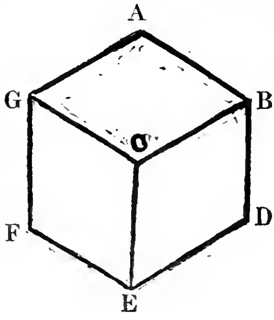
Notice respecting Professor Farish's Isometrical Perspective. By the Editor.

Professor Farish, of the University of Cambridge, in England, has introduced a new mode of drawing in perspective, which is peculiarly applicable to the delineation of machinery, as the proximate and the most distant parts of the thing represented which lie in the

same plane, are all drawn to the same scale. The designation "*Isometrical,*" was given to it by its inventor, to express this fact, as it signifies *to the same measure.* The great peculiarity in this mode of drawing in perspective, is, that there is no vanishing point; or, what is the same thing, the vanishing point may be considered as at an indefinite distance from the object. Perhaps a clear idea of the principle upon which such a representation depends, may be obtained by supposing a telescopic view of a single and distant object to be delineated. Let a carriage, for example, be placed at the distance of a mile from the observer, and that to obtain a distinct view of it, he looks at it through a telescope. From a point of sight so distant, every part seen in the same plane, will, as to sense, appear *Isometrical,* and the scale which would measure the nearer, would also measure the more distant wheels.

We are not aware that, in this country, this kind of perspective has been employed previously to the adoption of it by Mr. Howard in the representation of his rail-way carriage, Fig. 4th, Plate 8th, of this volume.

To give an exact representation of the proportionate dimensions of a machine, it has been common to exhibit it orthographically in its three principal directions, one on the horizontal plane, and two on vertical planes, at right angles with each other. This mode may be seen by referring to Figs. 1 and 2, Plate 7, and Fig. 1, Plate the 8th. In the drawing, Fig. 4th, the view of the carriage is supposed to be taken on the same horizontal plane on which it stands, and all the parts on the two vertical planes, are, consequently, *Isometrical.* If we suppose the eye of the observer to be elevated, so that a line drawn from it would meet the horizontal plane, and the planes of the vertical sections in the same angle, all the lines in these three principal directions would become *Isometrical.* Such a line professor Farish denominates the *line of sight.* To those who possess a knowledge of geometry, the representation of the cube in the margin, will give a perfect exposition of what is intended. The *line of sight* would pass through the angle C, and the centre of the cube, and the lines bounding all its planes would be *Isometrical;* and every angle measured at A, B, C, D, E, F, or G, would be either one of 60 or of 120°.



We hope that we have given a clear and popular account of this mode of drawing. Those who wish to examine it more at large, may do so by consulting a full analysis of it in Gregory's "Mathematics for Practical Men," which contains the author's own paper upon the subject, transcribed from the Transactions of the Cambridge Philosophical Society.

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